Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

#207

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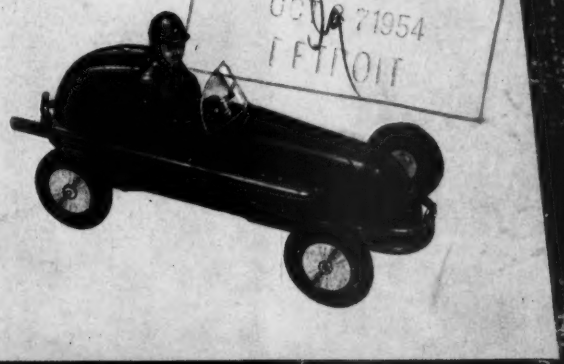

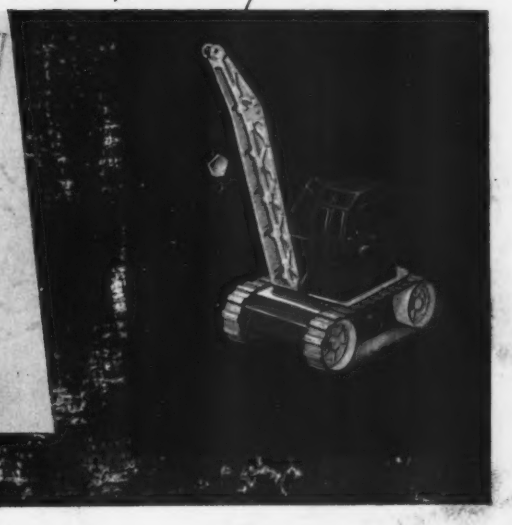

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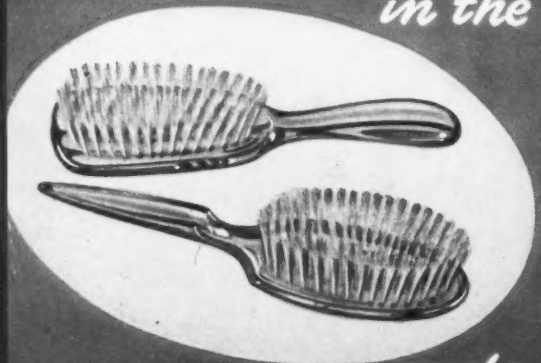
in the larder ... in the Bedroom ...



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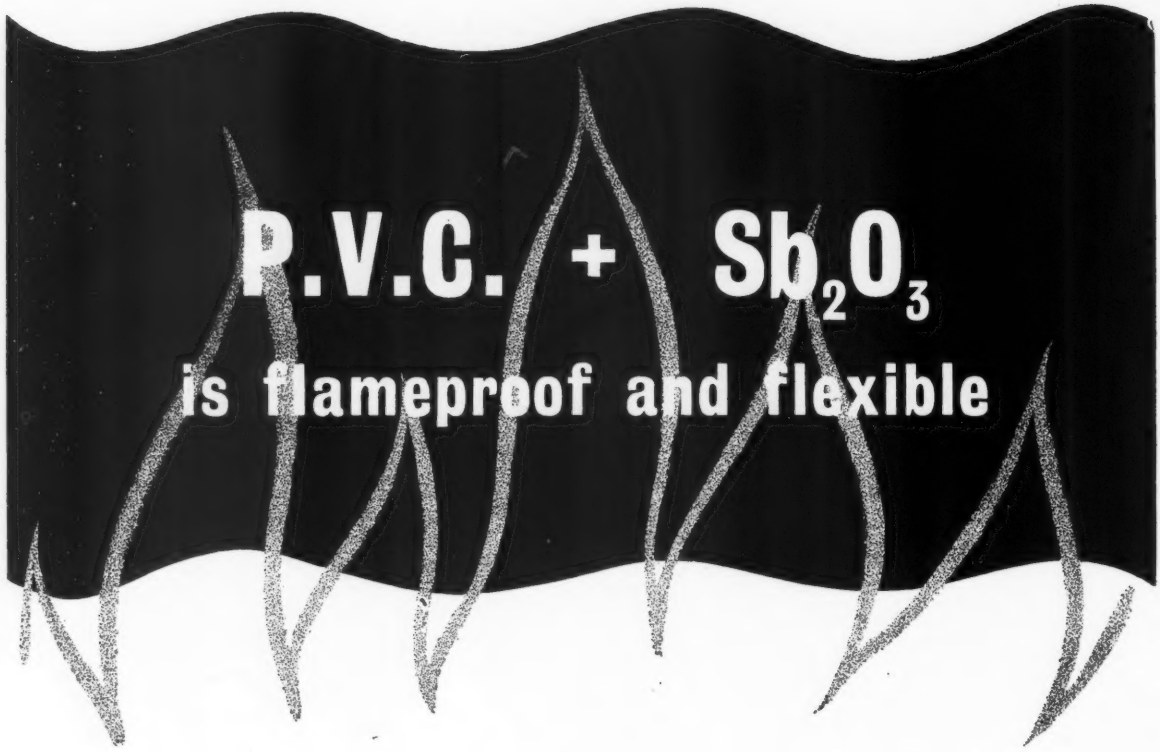

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* *These experiments are fully described in Geon Technical Note G.T.N.9.*

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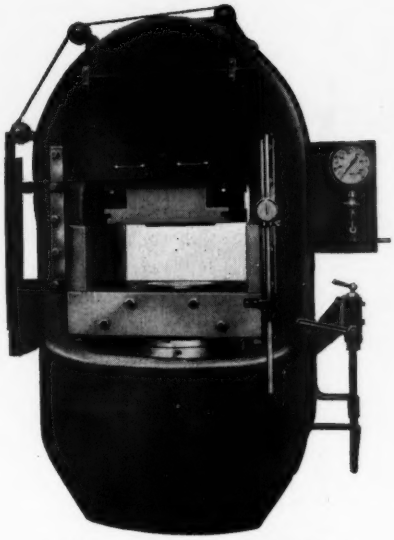
high-quality compression moulding machine specialists



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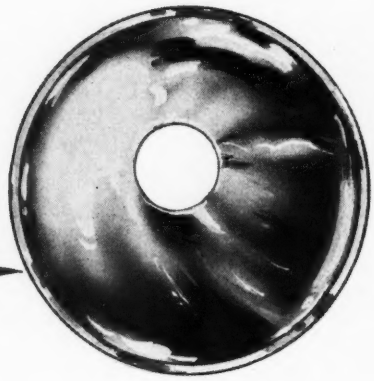
reflectors processed in



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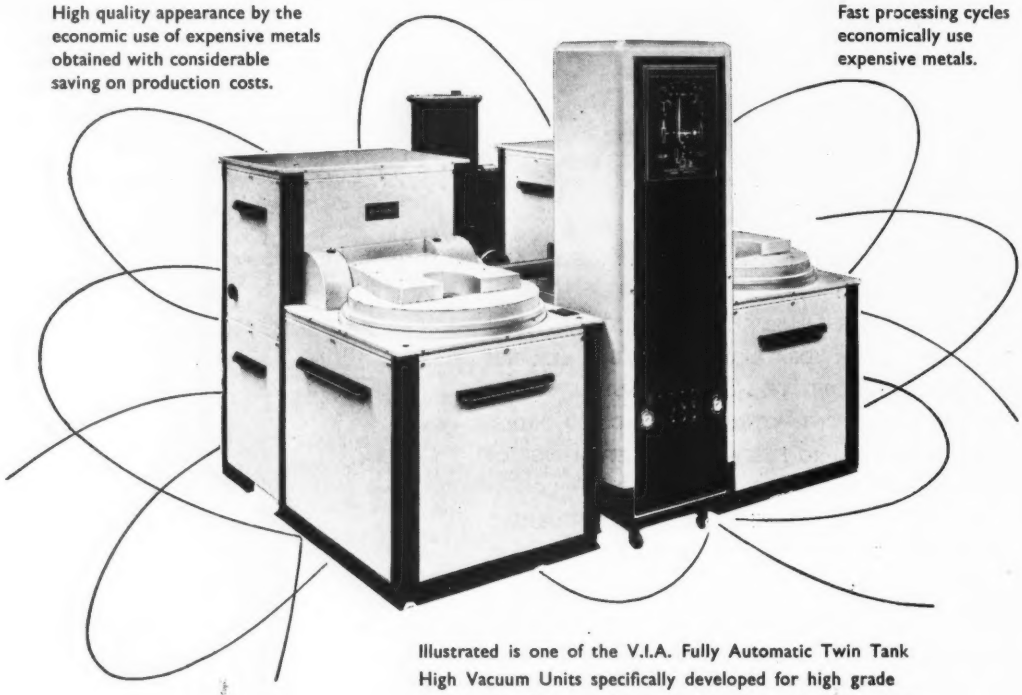
High quality appearance by the economic use of expensive metals obtained with considerable saving on production costs.

Fast processing cycles economically use expensive metals.



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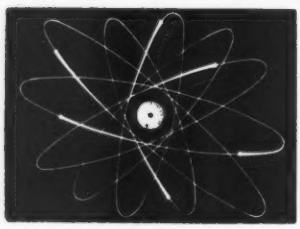

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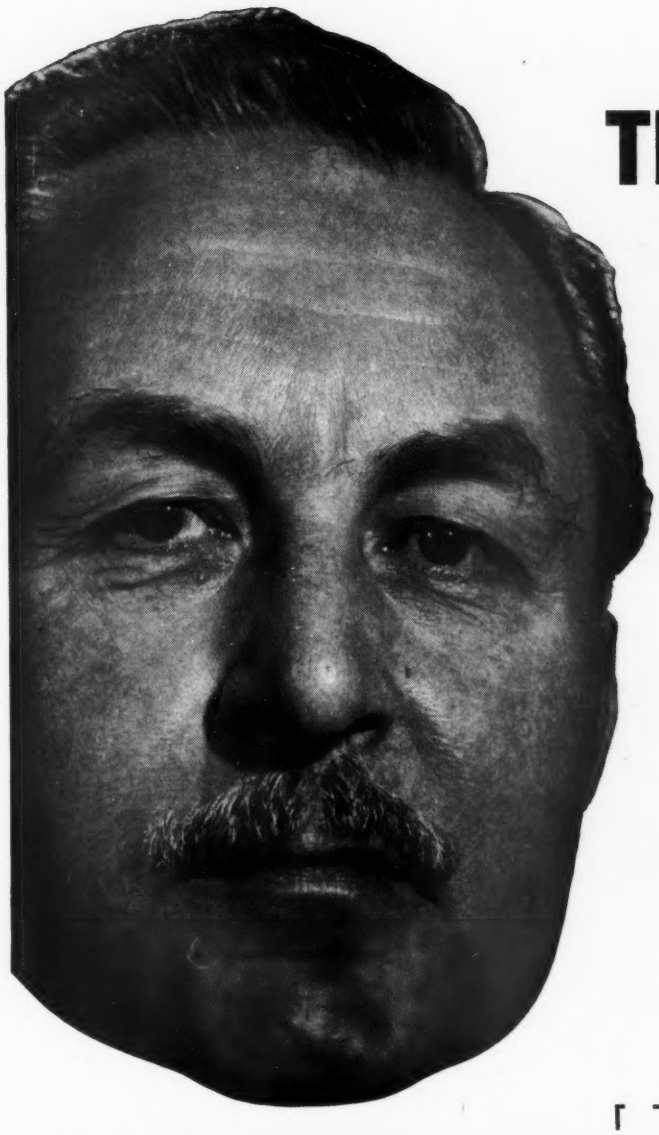

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16 OUNCE

. . . is by Injection Moulding on H.P.M. Equipment

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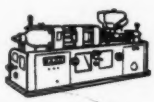
HPM



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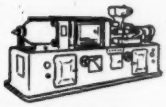

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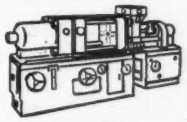

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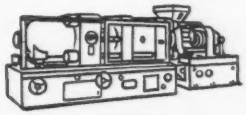

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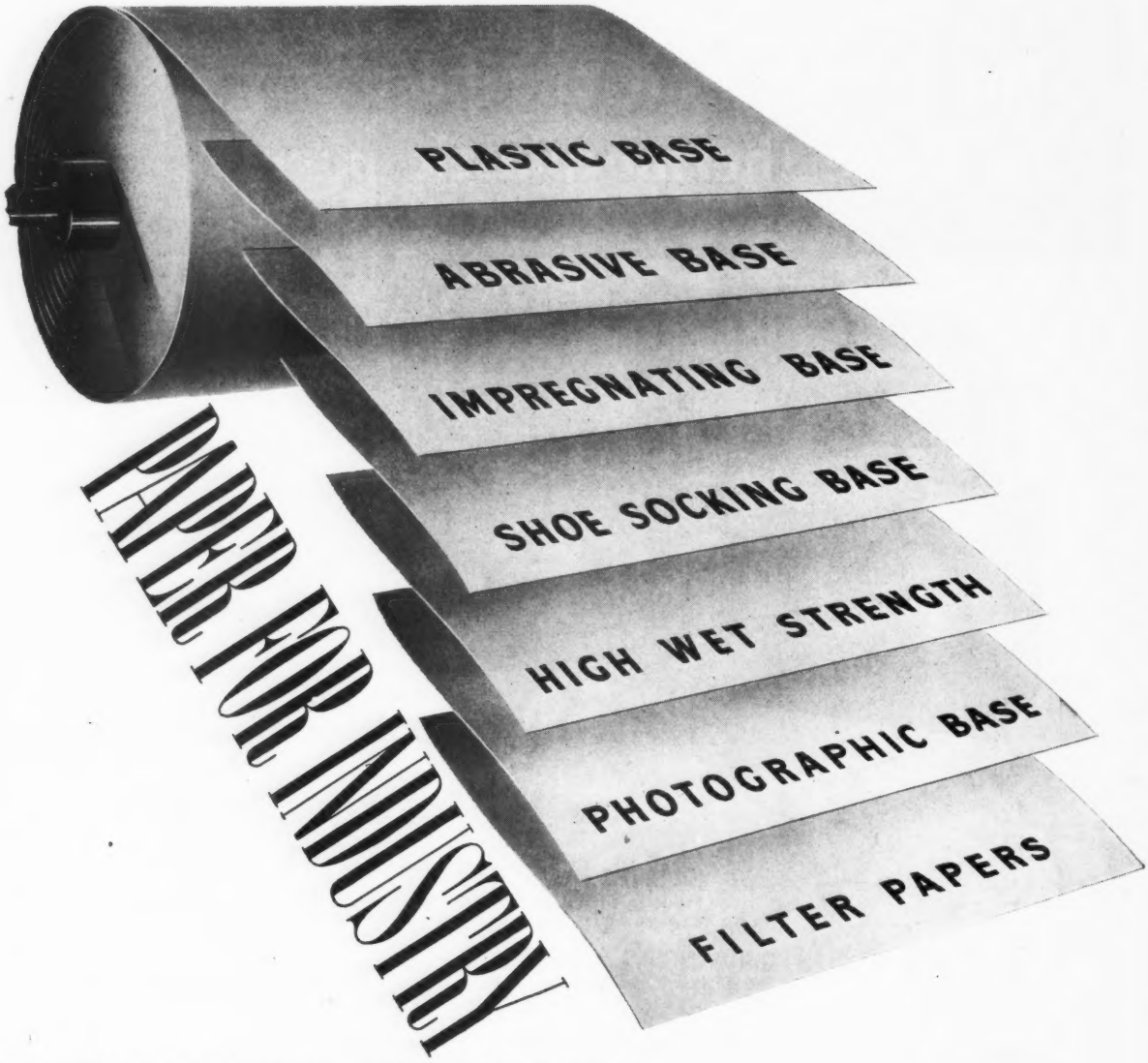

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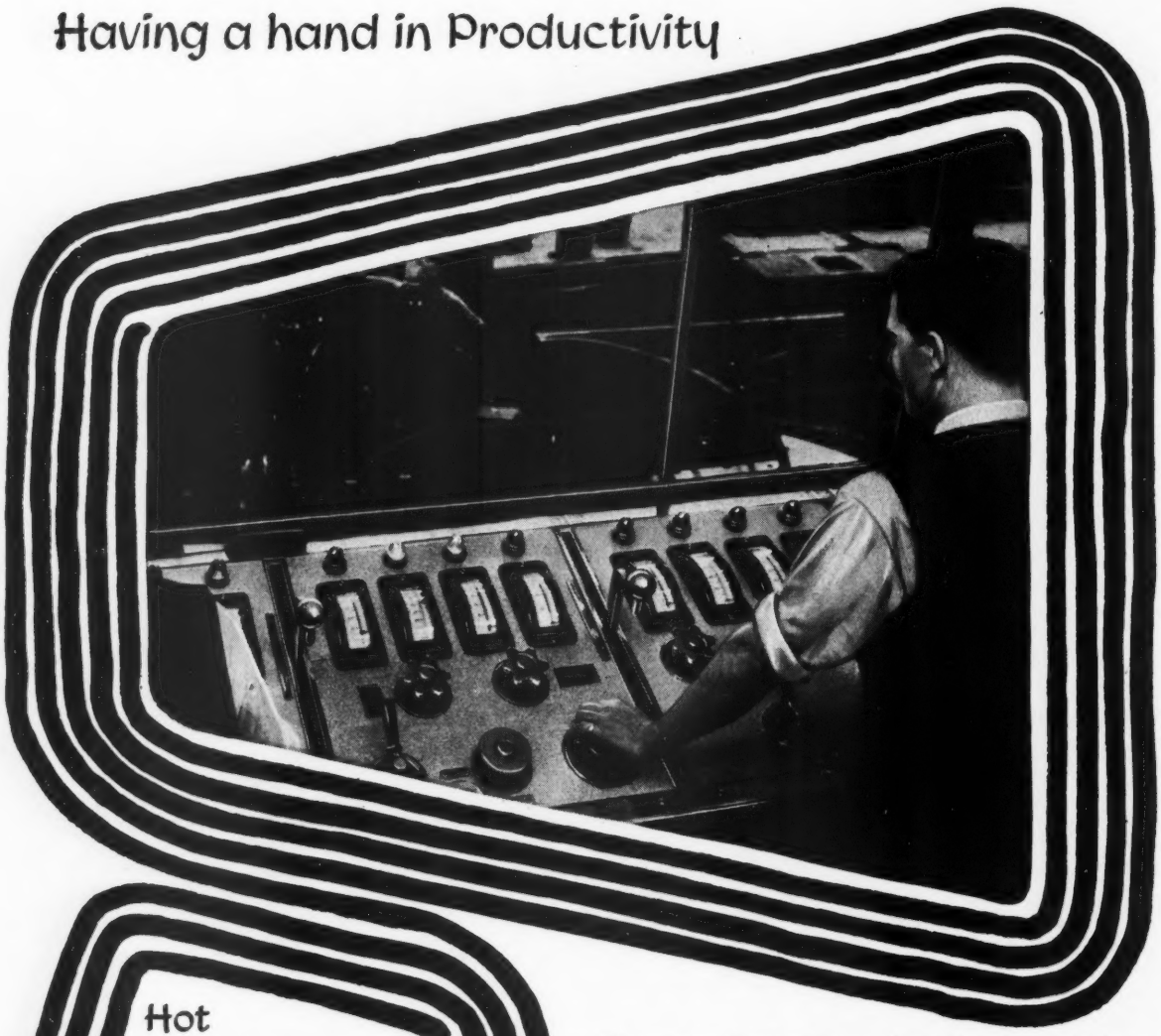

Hot Steel Driver

Scene: a steel rolling mill. Enter: one billet of white hot steel. Action: the billet goes in between the rollers; it comes out thinner but longer; the billet stops, reverses, shoots back. The heavy rollers stop, reverse, accelerate; the steel goes in again, through again, reverses again—and so it goes on. Full speed—stop—accelerate to reverse full speed. All as fast as possible, because increased output is urgently needed. Behind it, one man's hand on a controller. Without electric control, no process even half as fast.

Electric control is
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manufactured for and shown by courtesy of
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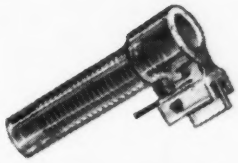

COIL FORMER in POLYSTYRENE
manufactured for and shown by courtesy of
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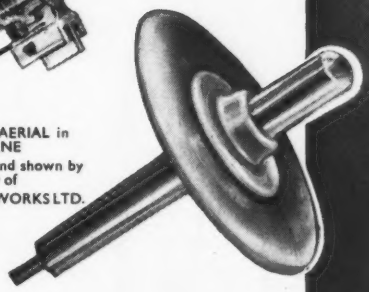

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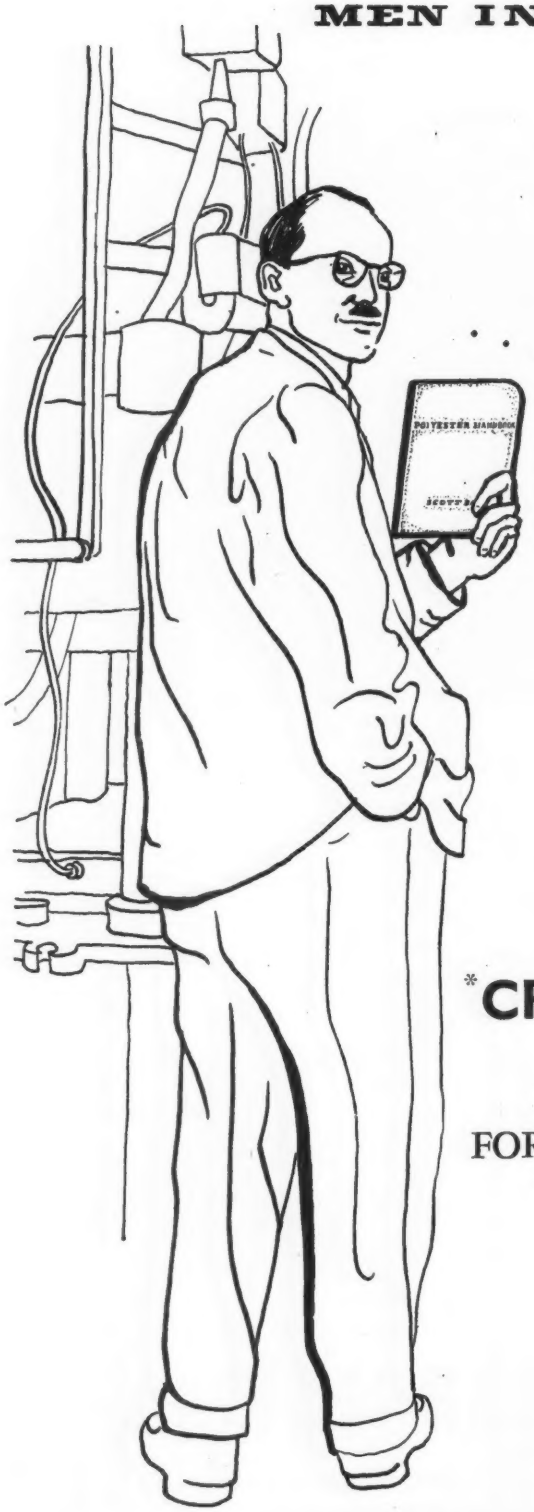
MEN IN THE KNOW NO 2.

(Works Manager)



. . . WE HAD OUR TROUBLES —

but that's a long time ago now.
You might call them the teething troubles
of new methods, and new materials.
But it's an old story to Scott Bader,
and since we took advantage of their
technical service we've had smooth
sailing all the way.

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pioneer polyesters

FOR ALL GLASS FIBRE
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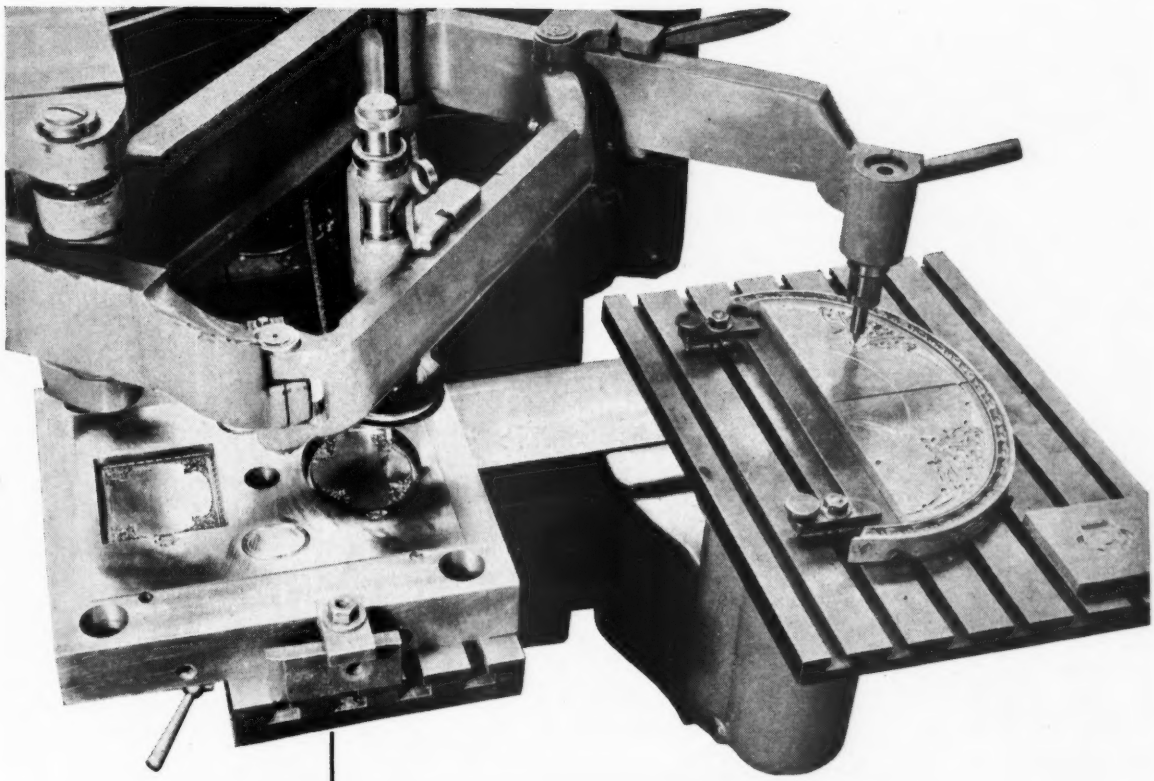
* *A.I.D. and A.R.B. approved.*



Reduction for quantity

A pantographic engraving machine, working on a reduction of 2½ to 1, sinking the mould for plastic reproductions of traditional Italian miniature frames.

Quantity production has displaced one kind of craftsman and created another — the toolmaker. Upon his skill depends the success of modern manufacturing techniques. This is true of the plastics industry, perhaps, more than any other.

We at Universal Tools are proud of the skill of our craftsmen. But that is not all — the important thing is that this skill is supported by unsurpassed knowledge of modern moulding techniques. Knowledge and skill combine to ensure that " Universal " moulds produce a job that is not only economic, but a little *better* into the bargain.

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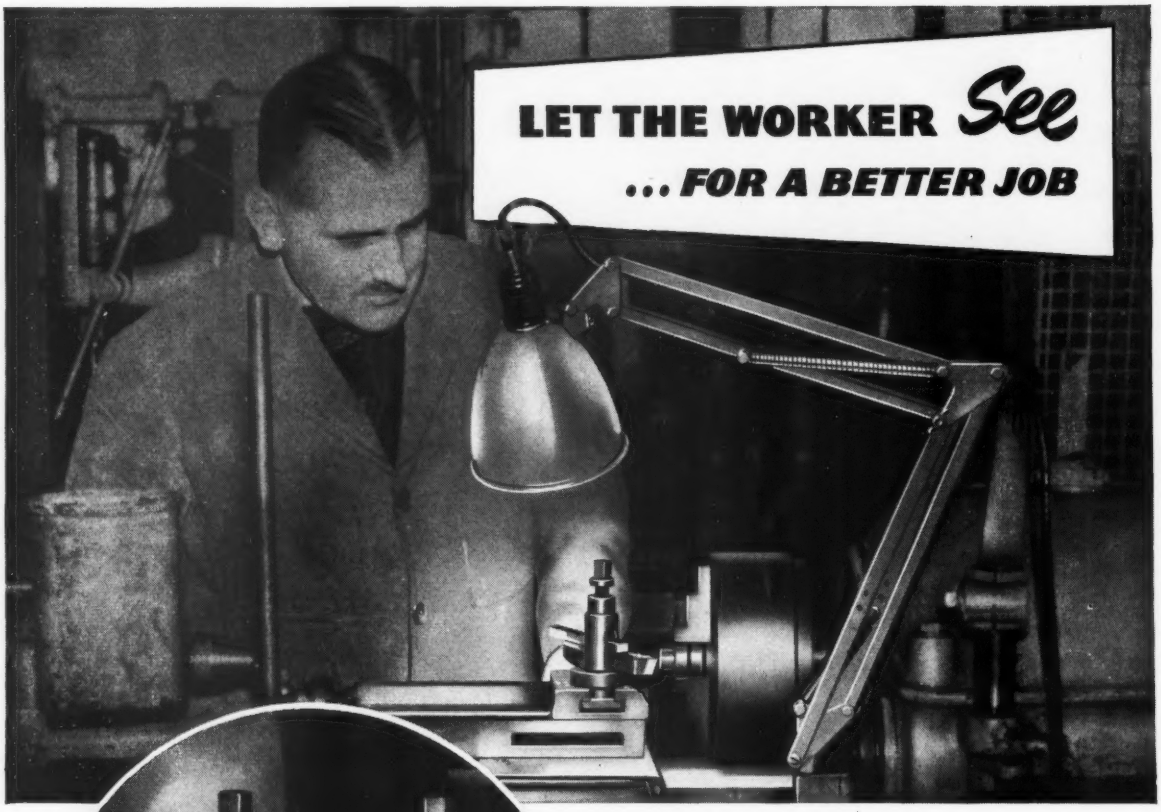

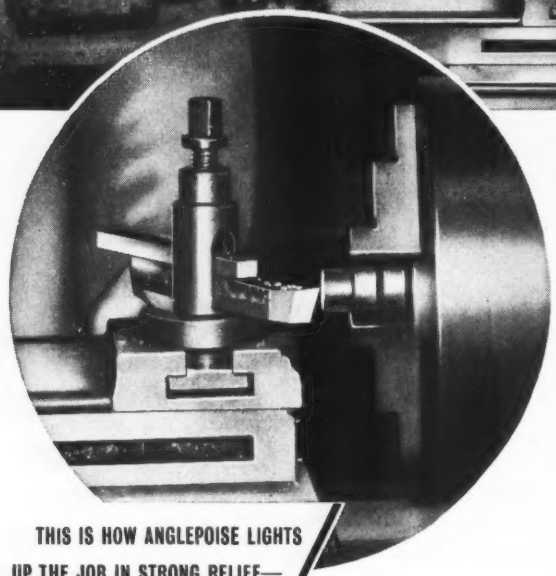

THIS IS HOW ANGLEPOISE LIGHTS UP THE JOB IN STRONG RELIEF— SAVING EYESTRAIN AND FATIGUE

Down a little! *Still nearer!* *Right on the job!*

Where a high degree of accuracy is called for, the call is equally for ANGLEPOISE. This fine lamp throws its clear, shadowless concentrated light right on the work only. This light 'follows' the job by the slowest of degrees by finger tip control. It takes any angle and 'stays put' until a finger touch moves it as required to a new position. Watch output go up with ANGLEPOISE in position.

Every machine-room, every workshop, every drawing office should have its battery of Anglepoise Lamps, with its finger tip obedience, its 1001 angles, as an aid to accuracy. Write today for fully descriptive Booklet (P.)

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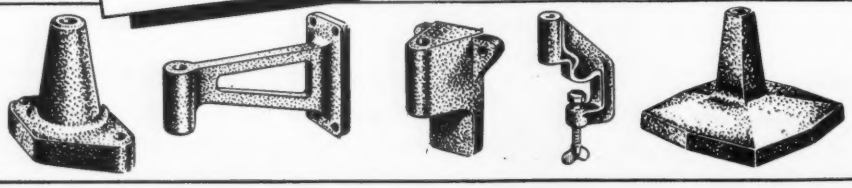

HT9

IN Erinoid TOUGHENED POLYSTYRENE

For the coloured handles of their plastic buckets the Halex Division of the British Xylonite Co. Ltd. have used Erinoid M.H.I. grade polystyrene. This medium impact material is tough, it is easy to mould, and it gives a good finish.

Erinoid Polystyrene is manufactured by

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Available as moulding powder, sheet and extruded sections

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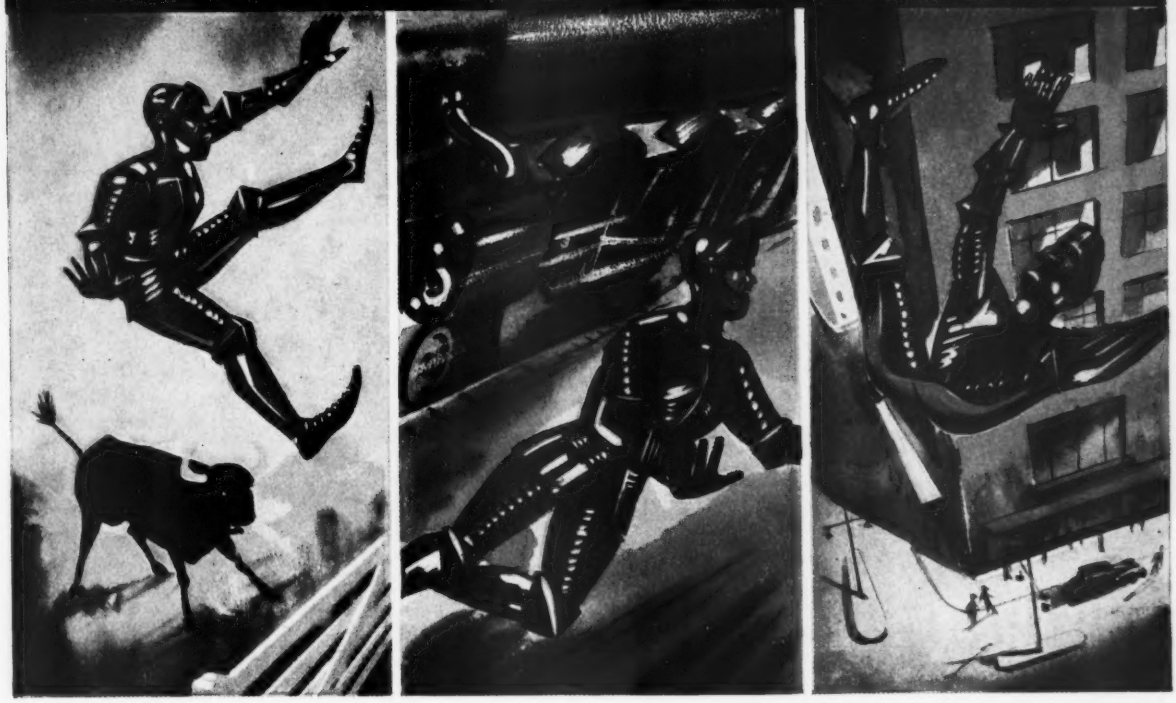
Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. PANILAX Laminated Materials and Mouldings. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS & TERMINALS. Distributors of Micoflex-Duratube Sleevings, Micoflex-Durasleeve (Plastics-covered flexible metal conduit), Durajoint (Patented expansion jointing for concrete structures) and Kenutuf Injection Mouldings (in most thermoplastics including P.V.C.)

A NEW "Nestorite" Powder ... with exceptional impact and flexibility properties ...



. . . AND — a test unique in the annals of Plastics History

NESTORITE

RX.305

Filler	mineral
Particle size (inches)	1/8
Specific gravity	1.65
Bulk factor	2.0—2.5
Powder density	.7—.8
Time of cure of test cup (secs.)	85—95
Shrinkage (thou./inch)	7.0—8.0
Flowability (cm.)	8—9
Brinell Hardness	10—12
Impact strength (ft./lb.)	.22—.28
Crossbreaking strength (lb./sq. in.)	5,500—6,000
Tensile strength (lb./sq.in.)	3,500—4,000
Elastic modulus in tension (lb./sq. in.)	3—5 x 10⁵
Water absorption (mg.)	110—150
Electric strength at 90°C. minute value (V/mil)	50—90
Surface resistivity after immersion (log 10ohms.)	10.5—11.5
Volume resistivity (as moulded) (log 10ohms.cm.)	11.0—12.0

It was Hercules who, after we had carried out our usual standard tests on this new product, suggested an additional and very drastic one.

He had always hankered after the idea of an "as-the-crow-flies" delivery service in urgent cases by slinging two or three drums round his neck and hedge-and-house hopping to customers.

"*Look*" he said, "*Let me prove indisputably the Impact and Flexibility features of RX.*305. *Make me moulded armour for my 'steeplechase'.*" "*But*" we argued, "*what about the cost of tools.*" "*Oh, Vulcan will see to that*" he retorted.

So—habited as a knight of old, Hercules sallied forth in his plastic armour with his three drums of RX.305 and delivered them to our Customers in record time.

Trials on his return journey included:

(*a*) *Being tossed by a bull.*

(*b*) *Suffering a glancing blow from an express train.*

(*c*) *Falling from the roof of a high building.*

However, he returned safely with courage undaunted and armour undented.

RX YOU'RE RIGHT WITH 'NESTORITE'

JAMES FERGUSON & SONS LTD.

LEA PARK WORKS, PRINCE GEORGE'S RD., MERTON ABBEY, LONDON, S.W.19

Telephone: MITCHAM 2283 (5 LINES) Telegrams: NESTORIUS SOUPHONE LONDON

A: S. HARRISON & CO., PTY. LTD., 85, Clarence St., Sydney, Australia. 120, Wakefield St., Wellington, New Zealand.

ANDRE BERJONNEAU, 134, Avenue de Villiers, Paris 17, France.

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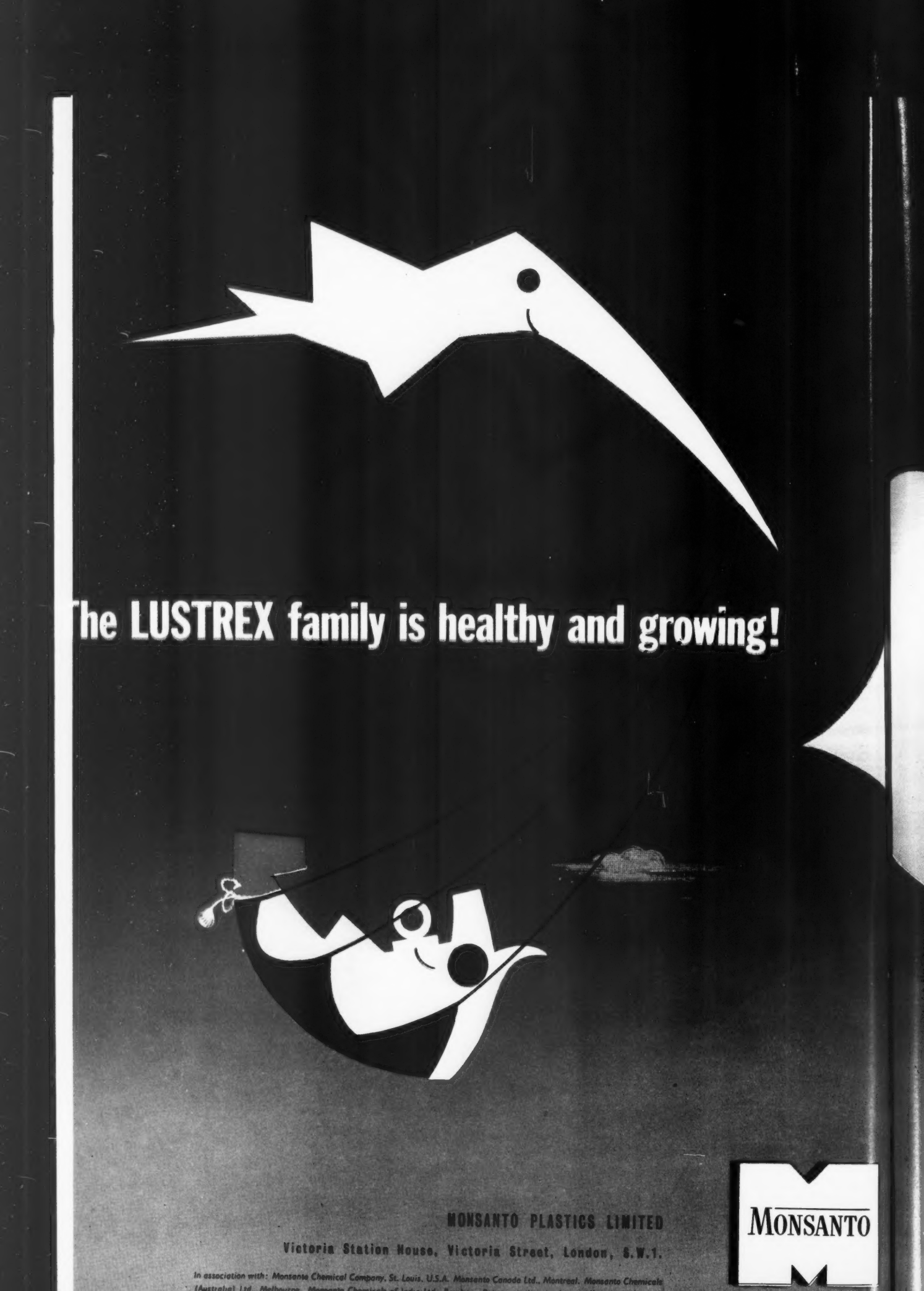
EINAR HOLMARK, 19, Gl. Kongevej, Copenhagen V. Denmark.


The LUSTREX family is healthy and growing!
MONSANTO PLASTICS LIMITED
Victoria Station House, Victoria Street, London, S.W.1.
In association with: Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Ltd., Montreal. Monsanto Chemicals
MONSANTO

Monsanto's well-known and versatile polystyrene, Lustrex*, now meets more needs than before! Light yet strong, Lustrex can be easily and quickly fabricated by the injection-moulding process. It has a better and more lustrous finish than any other comparable material. Mouldability is excellent—any shape can be produced. Any colour can be matched, for the colour range is wide—transparents, opaques, and translucents. In addition, the grade known as Colourant Blend enables you to create any shade you desire using only simple equipment.

For even greater strength—Lustrex Toughened 1. With 3 times greater impact strength, 6-8 times greater deflection at break, 10-15 times greater elongation at break and very good ageing properties, Lustrex T1 is ideal for extra-impact requirements. Write now for full information. *(*Registered Trade Mark)*

SULPHAMIC ACID

(Amino Sulphonic Acid)

the mineral acid in solid form,
dry, colourless, odourless,
easy to measure, easy to handle,
easy to pack, easy to store,
easy to transport

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For solvent- and oil-resistant industrial clothing · upholstery sheeting
p.v.c. sheet for food wrappers · conveyor belts for foodstuffs

HEXAPLAS PPA

(*polypropylene adipate*)

A PLASTICISER

with low extractability · virtual non-migration · extremely low volatility
for vinyl chloride polymers · copolymers · selected synthetic rubbers

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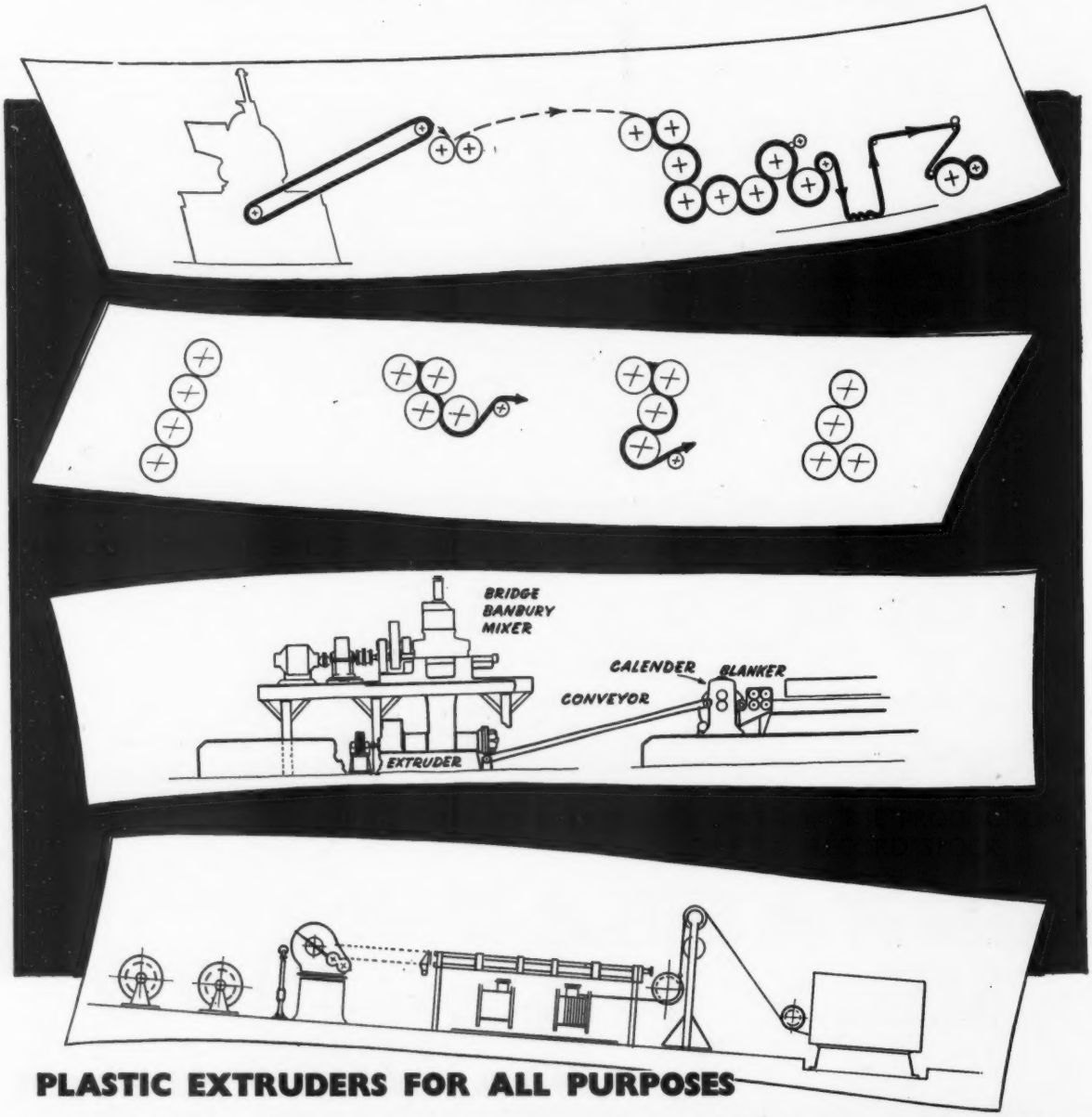
BRIDGE

the Hall-mark for Design Service and Performance in

RUBBER and PLASTICS MACHINERY



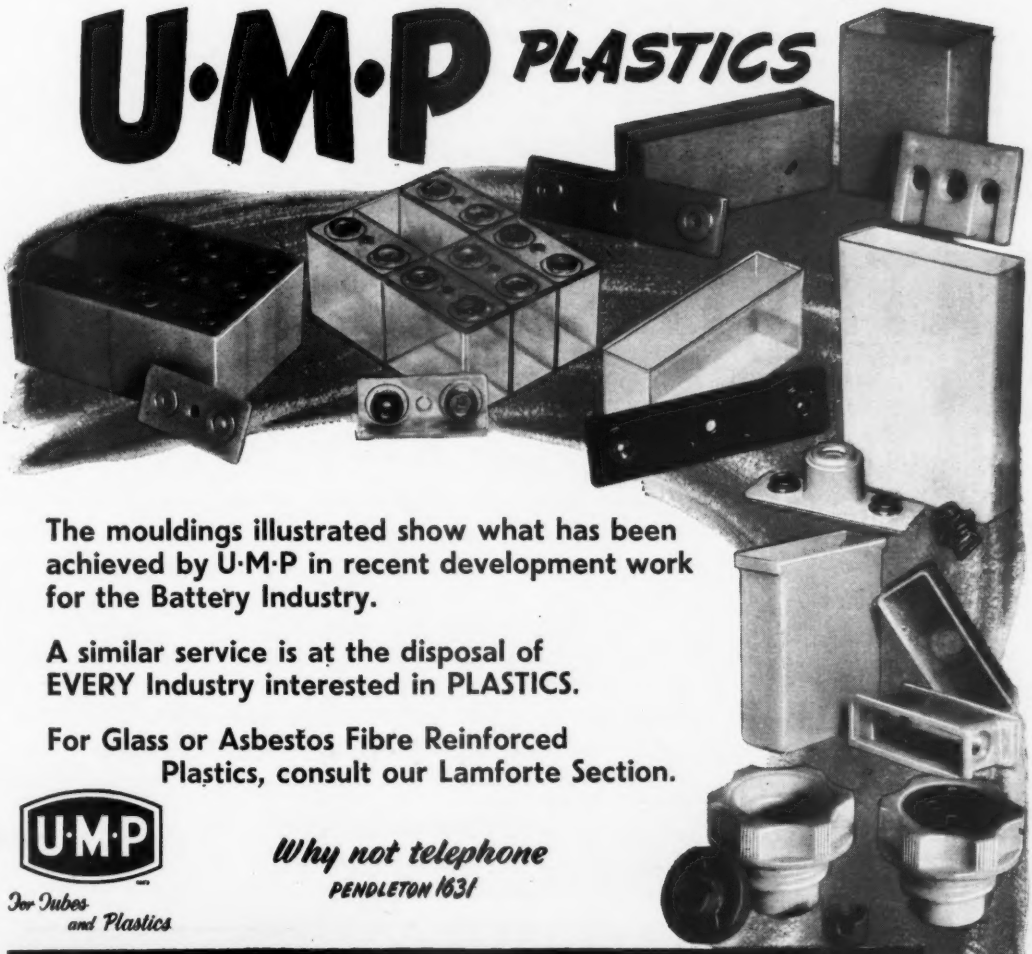
PLASTIC EXTRUDERS FOR ALL PURPOSES

DAVID BRIDGE & Co LTD CASTLETON, ROCHDALE, ENGLAND.

Specialist Engineers to the Rubber, Plastics and Associated Industries

LONDON OFFICE, BROUGHTON HOUSE, 6, 7, 8, SACKVILLE ST., PICCADILLY, W.1.

Out in front
AND STAYING THERE!
U·M·P PLASTICS



The mouldings illustrated show what has been achieved by U·M·P in recent development work for the Battery Industry.

A similar service is at the disposal of EVERY Industry interested in PLASTICS.

For Glass or Asbestos Fibre Reinforced Plastics, consult our Lamforte Section.

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For Tubes and Plastics

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UNIVERSAL METAL PRODUCTS LTD.
SALFORD 6 LANCS. *Telephone:* PENDLETON 1631-2-3
LONDON OFFICE: ARGYLE HOUSE, 29/31, EUSTON ROAD, N.W.1. TEL. TERMINUS 2073

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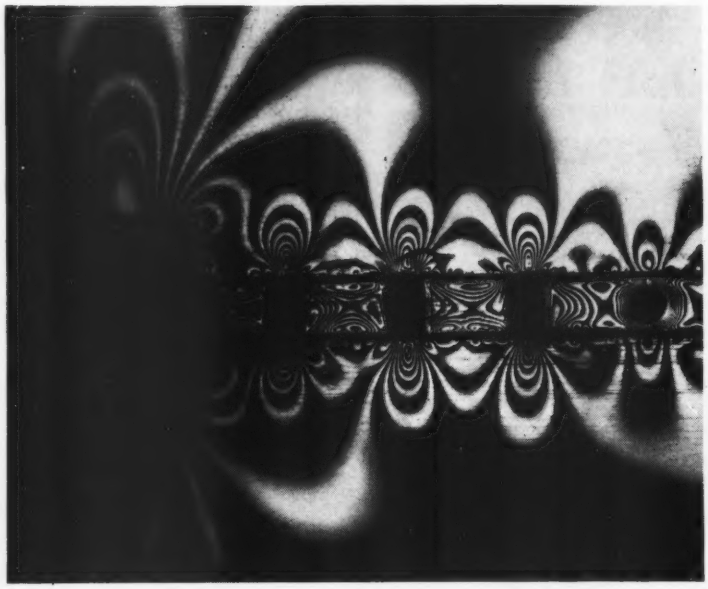

Photoelastic analysis of stress in and around coal pillars during mining operations.

Reproduced by courtesy of "Colliery Engineering" and Professor E. L. J. Potts, University of Durham.

CATALIN 800

CAST RESIN

The material you need for PHOTOELASTIC STRESS ANALYSIS

CATALIN 800 . . . the transparent cast resin produced specifically for the study of stress distribution problems by the photoelastic method, possesses a combination of properties unrealised in many other materials.

Accurately hardened for easy machining, CATALIN 800 has a high stress-optical coefficient and modulus of elasticity, freedom from initial stresses, absence of undue mechanical and optical creep, and maintains a constancy of properties during moderate changes in temperature. Widely used in the study of two-dimensional models, CATALIN 800 also gives highly satisfactory results in the investigation of three-dimensional stress distributions by the 'frozen stress' method.

Supplied in plate, rod, tube and block form.

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for Research and Design Engineering . . .
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research and manufacturing facilities are available to any Industry who is seeking to broaden the range or scope of their materials.

Our activities embrace:

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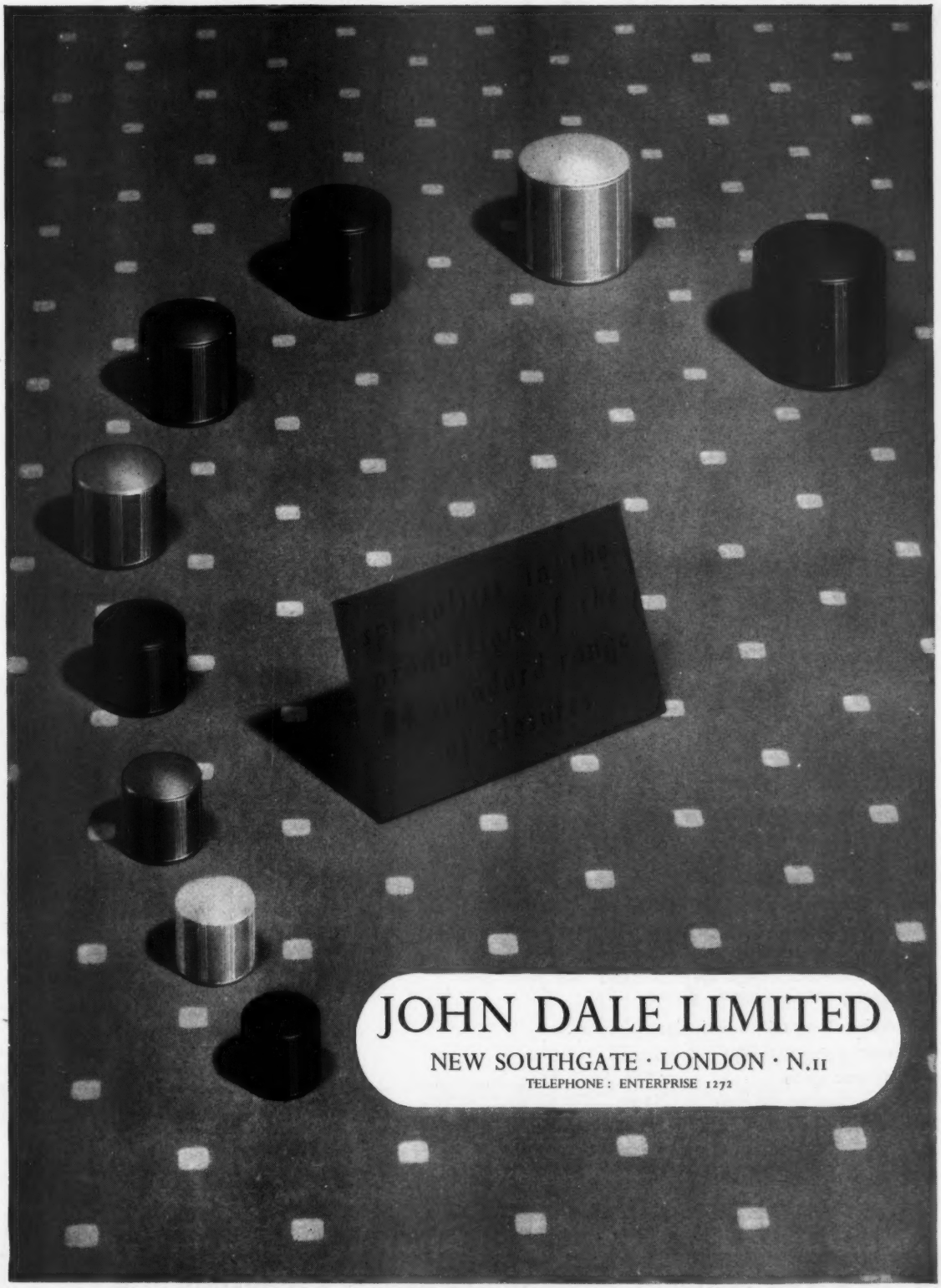
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NEW SOUTHGATE · LONDON · N.11
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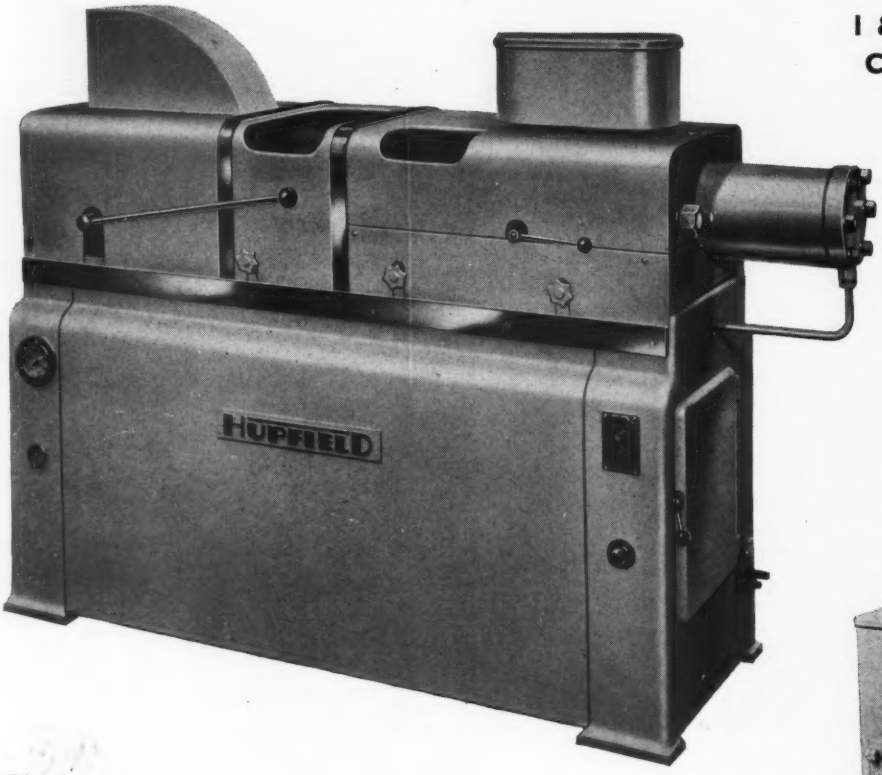
HUPFIELD *Plastics*

INJECTION MOULDING MACHINES FOR ECONOMICAL PRODUCTION

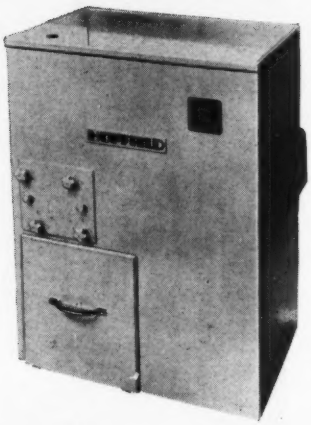
1 & 2 OUNCE CAPACITIES



These low priced hydraulic operated moulding machines, are designed for the rapid production of thermo-plastic mouldings on a low cost basis. Being operated by a single lever they are simple to use, ideal for female labour. Fitted with compensating feed mechanism and the latest Tem-Con automatic temperature control. All parts are standardized.

Completely self-contained with electric motor.

Machine moulding capacity	1 oz.	2 oz.
Moulding area up to	12 sq. in.	22 sq. in.
Plasticizing capacity per hour	11 lb.	22 lb.
Shots, subject to mould design	350 per hr.	250 per hr.

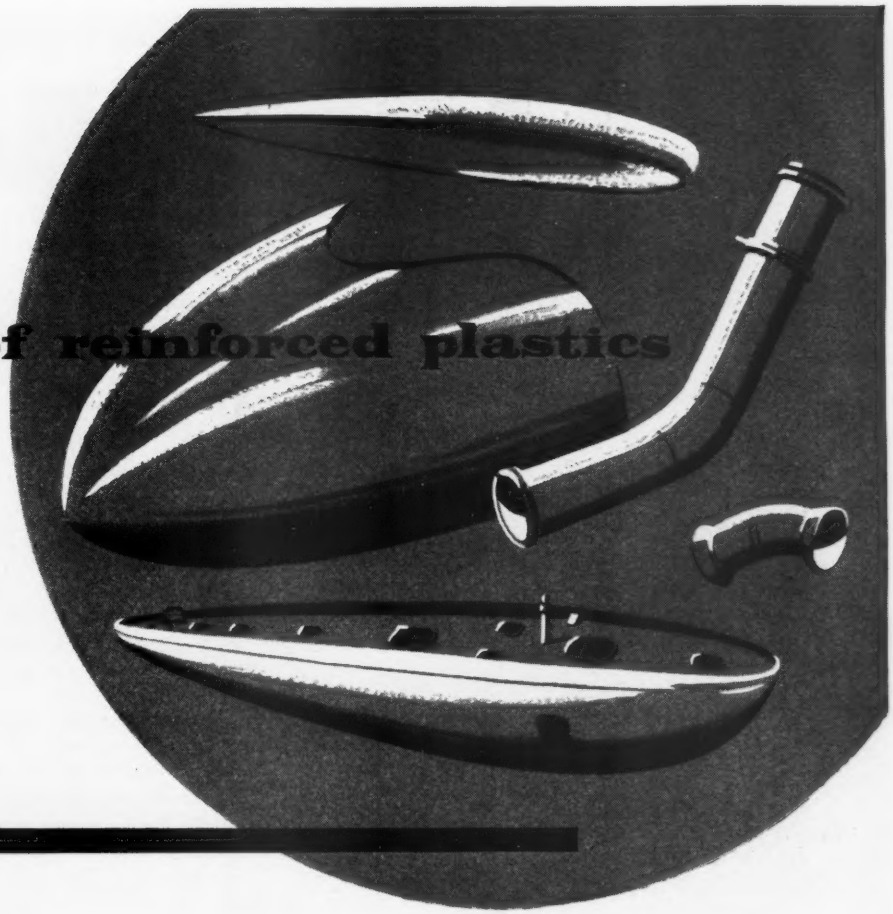


This fully enclosed machine will granulate any type of thermo-plastic material, is very rapid and smooth in action. The cutting blades are adjustable and can be very quickly cleaned. Completely self-contained with 2 H.P. electric motor.

Write for particulars, or telephone our Works (Wordsworth 4488) for a demonstration.

HUPFIELD BROTHERS LIMITED WORKS AND OFFICES

DALSTON GARDENS · STANMORE · MIDDLESEX : ENGLAND



Think of reinforced plastics

Think of DURAGLAS reinforcements

"Duraglas" pure glass products provide structural materials for the reinforcing of plastics. "Duraglas" has a high degree of strength, low weight and ease of fabrication. It is available in many forms, and suitable for a wide variety of structural applications. Full information will be willingly supplied to manufacturers who specify their particular requirements.

- WOVEN GLASS FABRIC
- WOVEN GLASS ROVING
- GLASS ROVING
- WOVEN GLASS TAPE
- CHOPPED GLASS ROVING
- BRAIDED GLASS SLEEVING
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DURAGLAS

REGISTERED TRADE MARK

PURE GLASS PRODUCTS

TURNER BROTHERS ASBESTOS CO. LTD. ROCHDALE ENGLAND

A MEMBER OF THE TURNER & NEWALL ORGANISATION

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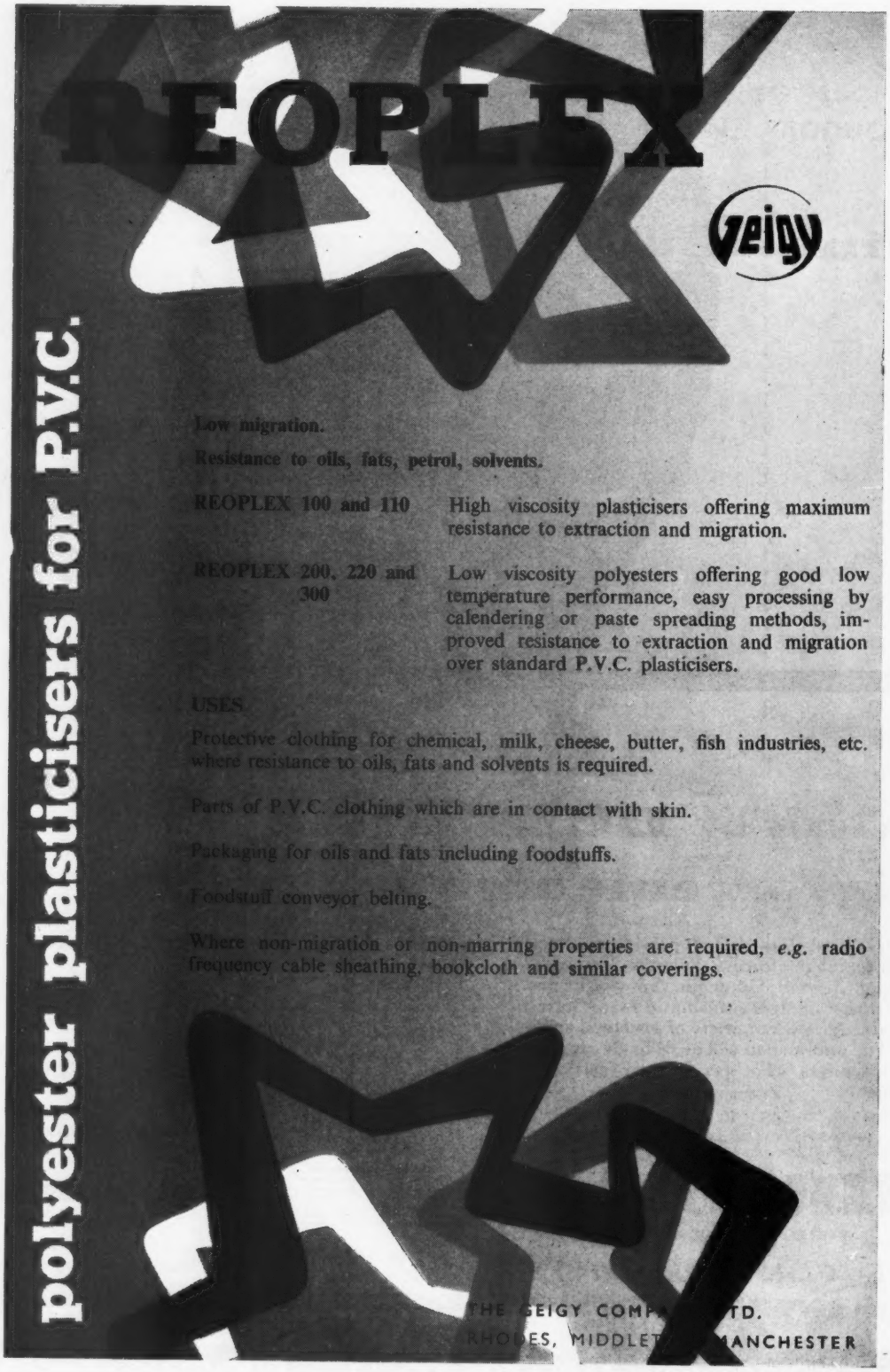

REOPLEX
Geigy
polyester plasticisers for P.V.C.
Low migration.
Resistance to oils, fats, petrol, solvents.
REOPLEX 100 and 110
High viscosity plasticisers offering maximum resistance to extraction and migration.
REOPLEX 200, 220 and 300
Low viscosity polyesters offering good low temperature performance, easy processing by calendering or paste spreading methods, improved resistance to extraction and migration over standard P.V.C. plasticisers.
USES.
Protective clothing for chemical, milk, cheese, butter, fish industries, etc. where resistance to oils, fats and solvents is required.
Parts of P.V.C. clothing which are in contact with skin.
Packaging for oils and fats including foodstuffs.
Foodstuff conveyor belting.
Where non-migration or non-marring properties are required, e.g. radio frequency cable sheathing, bookcloth and similar coverings.
THE GEIGY COMP TD.
RHODES, MIDDLET MANCHESTER
P.32

INJECTED or EXTRUDED

PECO

MAKE THE MACHINES -THAT DO THE JOB

Illustrated literature is available on all PECO machines and will be gladly sent on request.

Peco Injection Moulding Machinery is now well established throughout the world as equipment in which the best engineering skill and experience are combined with the latest developments in Plastic technology.
A recent addition to the PECO range of machines for the Plastics Industry is the 2½" Universal Extrusion Machine which is illustrated above. This machine aroused much interest at the 1953 Plastics Exhibition in London.

PECO PRODUCTS

Enquiries to :

PECO MACHINERY SALES (Westminster) LTD.

28, VICTORIA STREET :: LONDON, S.W.1. :: ENGLAND
Telephone: ABBey 1793/4/5 Telegrams: PROFECTUS, SOWEST LONDON Cables: PROFECTUS LONDON
Reg. Office and Works:
THE PROJECTILE & ENGINEERING COMPANY LTD, ACRE STREET, LONDON, S.W.8

REVOLUTIONARY

Kleestron D.S

WILL ATTRACT YOUR CUSTOMERS

YET IT COSTS NO MORE TO USE THAN ORDINARY POLYSTYRENE!

Just tie up these advantages with the fact that KLEESTRON 'D.S.' cannot pick up dust like ordinary polystyrene! *To you* it means easier production with better goods than ever before . . . at no extra cost. *To your customers* it means more appealing products . . . at no extra cost.

IT'S REALLY FLEXIBLE!

IT'S SPLIT-PROOF!

IT'S SHATTER-RESISTANT!

No wonder plastics men everywhere are turning over to the polystyrene-with-a-difference, made under a patented formula, exclusive to Kleestron Ltd. No wonder more and more orders are being received weekly by manufacturers who specify . . .

Kleestron D.S.
DE-STATICIZED FOR LIFE

KLEESTRON LIMITED · WEST HALKIN

BUT WON'T ATTRACT DUST -like ordinary Polystyrene

Make a note now . . .

. . . that KLEESTRON 'D.S.' is tougher than ordinary polystyrene and far more flexible.

. . . that KLEESTRON 'D.S.' cannot retain electrostatic charges—cannot attract and hold dust particles.

. . . that KLEESTRON 'D.S.' has a similar impact strength to ordinary polystyrene but a lower (yet quite sufficient) tensile strength.

. . . that KLEESTRON 'D.S.' is very ductile and permits the moulding of undercuts, threads and inserts, which would normally be extremely difficult.

. . . that KLEESTRON 'D.S.' is, in its natural state, an opaque white material.

. . . that KLEESTRON 'D.S.' costs no more to use than ordinary polystyrene.

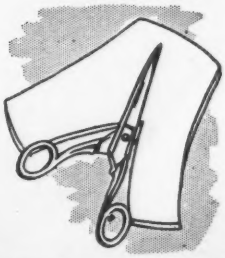
No modifications are needed in machine or mould

KLEESTRON 'D.S.' flows at lower temperatures than normal polystyrene. The range 350-500°F. is recommended; discoloration may take place at higher temperatures. For optimum results, a reduction of 50°F. in the cylinder temperature, together with an increase in pressure is most suitable. It may be possible to reduce duration of cycle times; and, certainly mould release should be improved.

BEND IT!
—it's flexible

DROP IT!
—it's really tough

DRILL IT!
—it won't shatter



CUT IT WITH SCISSORS!
—it's split proof

Kleestron D.S.

DIES FOR PLASTICS

FIRTH BROWN

Top photograph : Die by Messrs. Fox & Offord Ltd. for Messrs. Dorcam Ltd.
Bottom photographs by courtesy of The Metal Products (Treforest) Ltd.

THOS. FIRTH & JOHN BROWN LIMITED. SHEFFIELD

What's on your mind?

. . . a plastic moulding that you want in double quick time . . . an intricate design that requires expert tooling up? . . . whatever your own particular problems may be, we are here to do the worrying for you.

Our experience has been gained through years of painstaking research into every aspect of plastic moulding . . . our skilled technicians have at their command the most up-to-date precision equipment in tool room and moulding shop—there are no gaps in our production line.

From blue print to finished product we offer a sound, reliable service with competitive prices . . . why not get in touch with us NOW.

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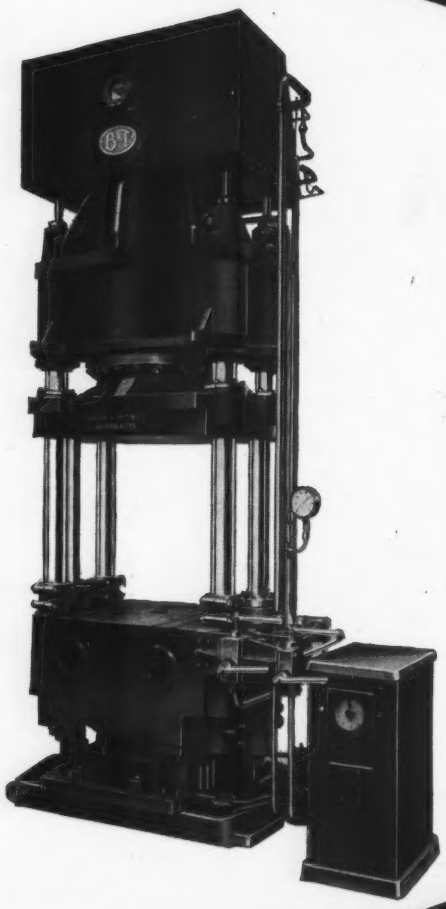
Smee's R105

HYDRAULIC PRESSES

WITH AUTOMATIC CONTROL



No. 984-350 ton self-contained Press with Automatic Control Unit.

FOR COMPRESSION MOULDING
IN SIZES UP TO 1,400 TONS CAPACITY

Bradley & Turton Ltd

CALDWALL WORKS KIDDERMINSTER

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THE LEADING MANUFACTURERS OF COMPRESSION MOULDING EQUIPMENT

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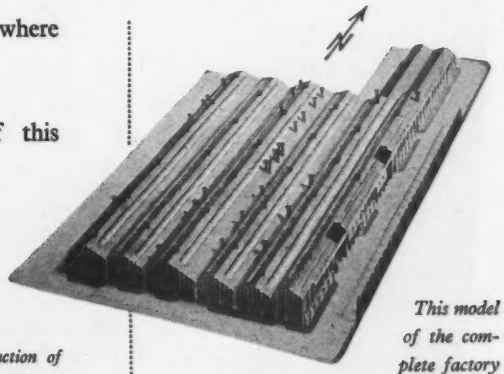
this was 'D' day!

The brisk assurance with which the completion date has been guaranteed depends of course upon a good deal of thought and organised planning beforehand — but *new ways of building* permit a daily production of reinforced concrete components, many of them 6 or 7 tons, to be transported from the factory of Beecham Buildings to the site where speedy and efficient building teams complete the job.

Further advertisements will tell the story of this contract and of the inevitable obstacles which will arise this Winter to test our guarantee, and to prove what Beecham Buildings can achieve.



This model of the complete factory will pin point-progress in the advertisements which follow. Progress to date includes the clearing of 120,000 cubic yards of earth and rock, levelling of the site, and the construction of the perimeter road.

Beecham Buildings

May we advise you on the construction of permanent and competitive Industrial Buildings?

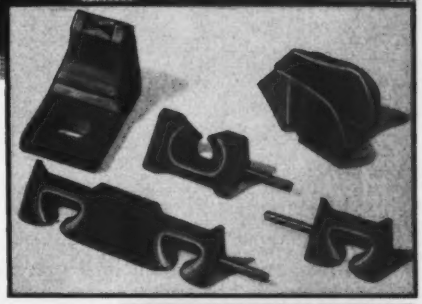
BEECHAM BUILDINGS LTD.
DEPT. K
SHIPSTON-ON-STOUR, WARWICKSHIRE
Telephone: Shipston-on-Stour 215 & 3287

211/40

You want the best

Beetle

B·I·P GROUP



Service
TO THE TEXTILE INDUSTRY

In the past thirty years the Textile Industry has brought us its problems and as a result one or other of our four factories has been able to help speed-up production, cut costs and produce better quality materials. We illustrate a random selection of compression and injection mouldings made by us for our friends in the Textile field.

But although we can claim to know a lot about the Textiles, it is only one of many industries we have been able to help. If you have a problem and think that the intelligent application of plastics could solve it, we are the people to contact.

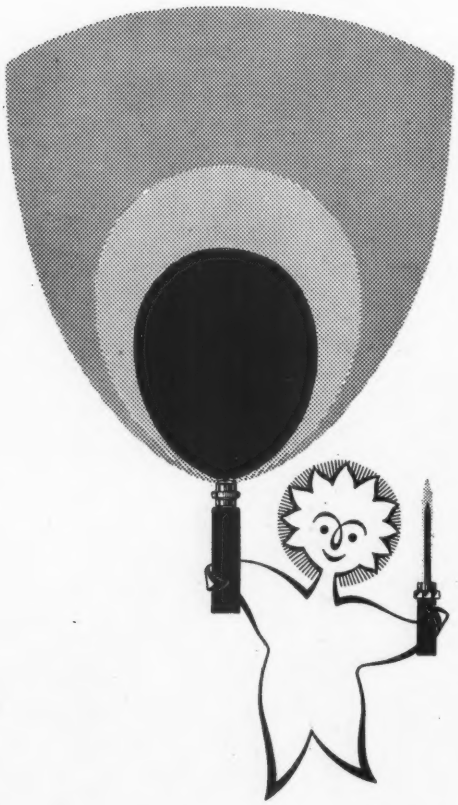
E. Elliott LIMITED
THE MOULDERS WITH THE ENGINEERING BACKGROUND

One of the three bays in our compression moulding works at Cheapside.

Some of the machines in our injection moulding works at Summer Lane.

★
FOUR FACTORIES AT YOUR SERVICE
★

E. ELLIOTT LIMITED, *Head Office & Works:* **315 SUMMER LANE, BIRMINGHAM, 19.** *Telephone: AST. CROSS 1156-7-8-9*



FLEXIBLE FLAMES

Some industries need a flame 20 feet long, others a mere pencil point of heat. Gas provides both and every gradation in between—a complete heat service for industry, clean, constant and infinitely controllable. The adaptability of gas is a virtue which can reward the user with lower production costs. However you put it to use, you pay only one bill for your gas. You do not have to budget for storage costs or space nor, unless your needs are exceptional, for special handling equipment and the concomitant labour. If yours is one of the 4,000 industrial processes already served by gas, you may find ideas for increasing efficiency in the latest advances in gas technology; if it is not, it could become the 4,001st. Either way the Gas Industry welcomes your inquiries.

Firm Facts

Questions about your own firm's gas usage can be answered by your Area Gas Board. The free advice and help given by the Boards' Industrial Gas Engineers are backed by full resources of the Gas Industry through the Gas Council's Industrial Gas Development Committee. The first step is to have this coupon filled in **and sent to your Area Gas Board or to the Gas Council, 1, Grosvenor Place, London, S.W.1.**

NAME .....

ADDRESS .....

WE NEED HEAT FOR 65

The Gas Industry makes the ***fullest*** *use of the nation's coal*

GCG10A

Beautiful Yorkshire
No. 6

The Village Pond, Burton Agnes

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'Yorkshire Post' Photograph

"ELO" SYNTHETIC RESIN PRODUCTS

Embracing Completed Mouldings, Moulding powders, Resins, solid, powdered, or in solution, Insulating Varnishes, Cements, Lacquers, Anti-friction resins for fabric bearings, Casting resins, Capping cements, Filling Compounds, Sealing fluids.

London Office: 79 Baker Street, W.1.

REMEMBER POPPY DAY

for Moulded Plastics Ask Crystalate to quote

COMPRESSION TRANSFER & INJECTION MOULDINGS INC. NYLON

CRYSTALATE LTD.
ASSOCIATING
MICA PRODUCTS LTD.

ALSO— S R B P TUBES BOBBINS & FORMERS

CRYSTALATE HOUSE, TONBRIDGE, KENT. PHONES TONBRIDGE 2261/5 (25 LINES)

54 years of service to British Industries

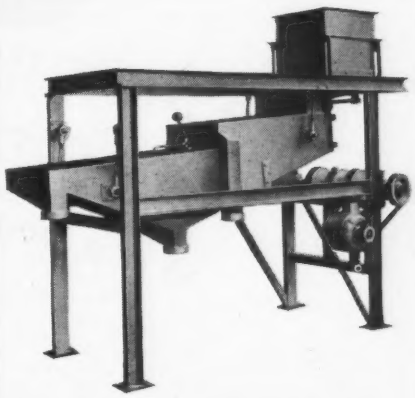
REMEMBER POPPY DAY

Is your sifter a **makeshift?**

talk to **GARDNERS** of Gloucester

The right sifter for the job, made by Gardners of Gloucester, will give you a bigger output of a finer product. Whether it be a brush or centrifugal sifter, or an oscillating sieve, every effort is made to give you simple operation and maintenance, and long and faithful service. Don't hesitate to ask for a special design or special features to suit your own particular requirements.

Whatever your problem in mixing, sifting, grinding or drying, it pays you every time to talk to Gardners.



The Gardner Oscillating Sieve

Suitable for a wide variety of dry materials and supplied with single or double sieves. Can be arranged for floor mounting or to be slung from under the floor. Mechanical feeder can be incorporated. Just one of the wide range of Gardner processing machines.

Send for illustrated folder describing 22 of the very large range of Gardner machines.

GARDNERS *of Gloucester*

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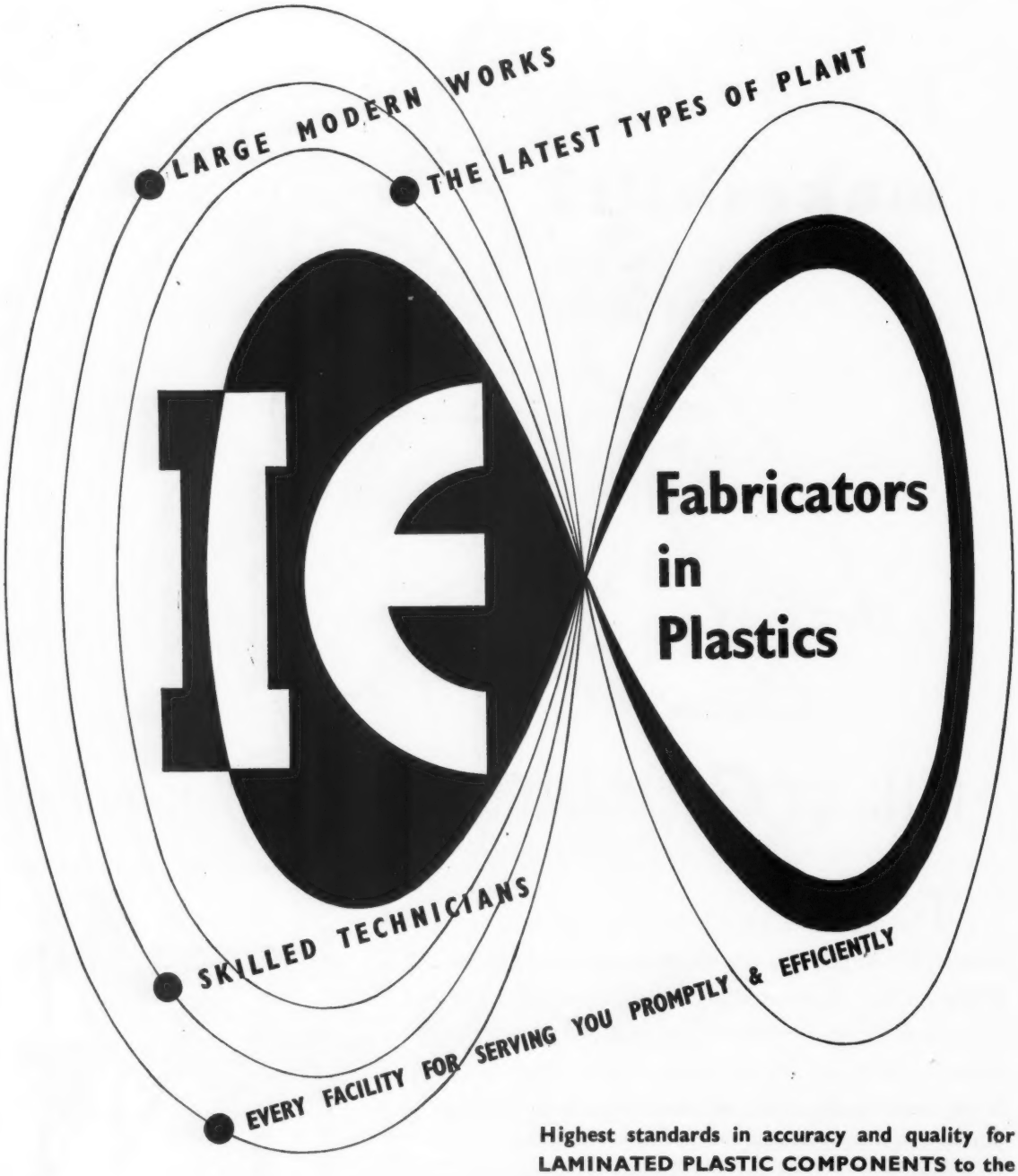

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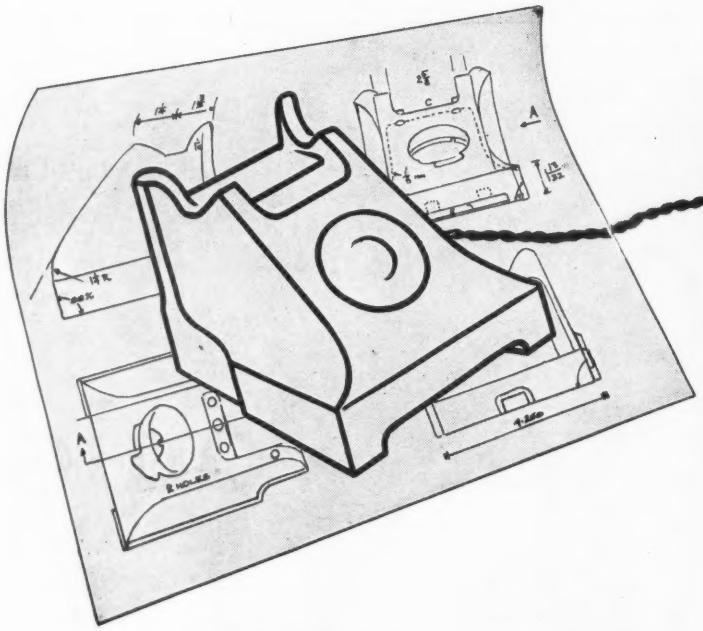

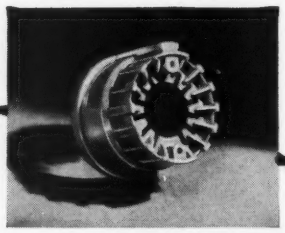

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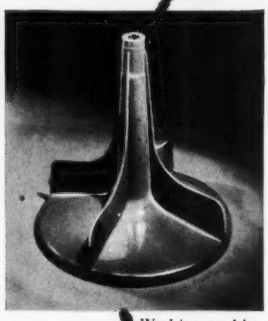

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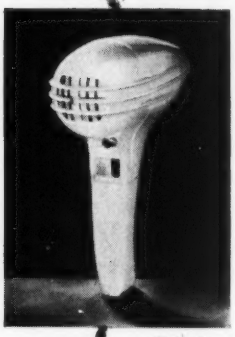

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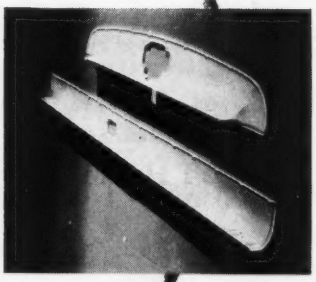

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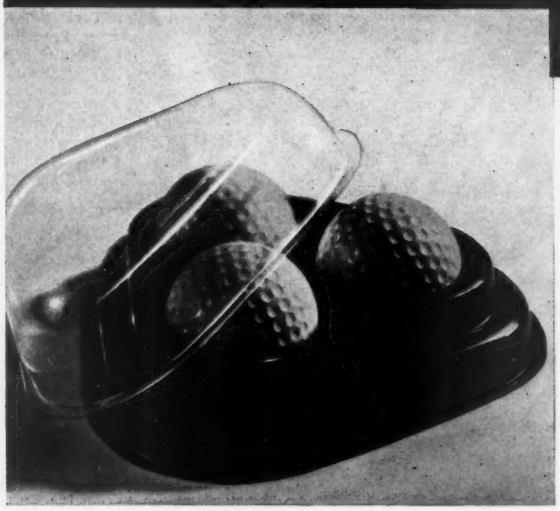

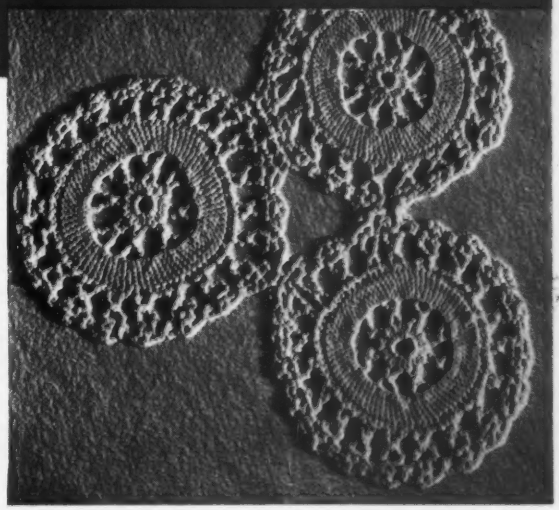

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Radio cabinets in phenolic material moulded at the Wilton Moulded Insulation Works of the General Electric Co., Ltd.

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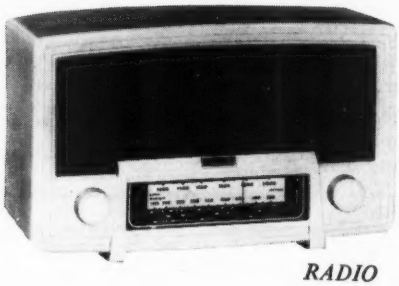

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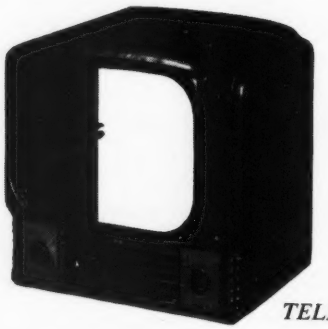

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Plastics

VOL. XIX. No. 207 OCTOBER, 1954

EDITORIALS

Plastics in the Air

IT has for many years been one of our chief pleasures to visit the Annual Flying Display and Exhibition organized by the Society of British Aircraft Constructors. In the early days our interest was personal, being partly nostalgic and partly excitement at the great strides forward that were being made in the design and speed of aircraft. Perhaps in no other industry was progress marked in so dramatic a manner.

It was some 16 years ago that we began to take a professional interest in these displays, although in those days "Perspex" was one of the few contributions from our industry. In recent years the increasing use of plastics in aircraft has been the subject of frequent comment, and we ourselves have devoted increasing space to this event.

As with most technical applications of plastics, the layman is almost completely ignorant of the part played by them in modern aircraft construction, a part that is increasing steadily in both the military and normal transport fields. When we remember that the total value of aircraft exported was 65½ million pounds during 1953 and that the rate of such exports, following recent news of supplying some of the United States needs for internal transport, will rise sharply in the future, we cannot but presume that in this field our interest is growing to be as important as in any other. The account on pages 326 to 331 of this year's exhibition, to which many more companies in our industry contributed than ever before, will throw a new light on plastics in aircraft.

Most of the important new applications are in the field of fabrications from the new laminates and include jigs and tools, new types of radomes, fairings, propeller spinners, fuel tanks, high-speed tow targets and unlabelled mysterious shapes that bear close resemblance to rocket constructions capable of travelling through the air at speeds much higher than sound. There was no exhibit this year of a complete wing or other large structure in the modern laminates as there was last year but it is known that experiments in this important and urgent direction continue and progress. No doubt the absence is due to security reasons. It is in this field that so much is unknown and, for our industry, that so much of the work is excitingly important. As is well known, the increasingly high speeds of modern aircraft have a great effect on the temperatures of the skin and at sonic and supersonic speeds temperatures attain dangerously high levels. Thus it is possible at 760 m.p.h. to reach a temperature of 190° F. on the skin. Moreover, the temperature is directly proportional to the square of the velocity and it has been proved that on models and on guided missiles moving at speeds of 1,500 m.p.h., temperatures of 1,500° F. and over have been reached.

It is also apparent that elevated temperatures (up to 500° F.) have less effect on the mechanical properties of structures made from glass fibre and asbestos laminates, especially of the "phenolic" impregnated type, than on light metals, and also possess weight advantages. (It has been stated that the strength of aluminium alloys is reduced to about 75% of the normal at 500° F.) Furthermore, the forming of such plastic structures made by simpler means and with relatively unskilled labour, presents economic savings that cannot be overlooked.

It is not an overstatement to say that the new conceptions in plastic structures may yet constitute the biggest step forward since Dr. Baekeland took out his patents on phenolic moulding powders in 1907.

Education and Plastics

ELSEWHERE in this issue we publish a contribution by Mr. R. R. Rolles who, apart from being chief chemist at British Moulded Plastics, Ltd., a position which lends considerable weight to his words, is also examiner in plastics technology to the City and Guilds of London Institute. What he has to say is of the greatest importance, we believe, to the plastics industry, which has now reached a level of development where proper education and training for its new personnel is essential. No industry of a scientific and technical type, such as is the plastics industry, can be expected to consolidate and grow unless it can draw upon a fund of completely trained scientists, technologists and engineers.

It is disquieting therefore to note Mr. Rolles words: "It is recognized that the total number of students attending part-times classes each year is small, and up to recently has shown a steady decline." It is difficult to comprehend how such a situation can exist when the industry itself is expanding, and when so many other branches of manufacture make use of plastics materials. One would expect attendance at technical colleges, where courses in plastics are available, to include not only representatives of the plastics industry but also personnel from packaging, paper, textiles and aircraft, as well as many other industries.

It is not surprising therefore that a note of alarm was raised at a conference on education in plastics held at the Borough Polytechnic last July. One of the delegates wanted to know if we were to be content to tag along behind the rubber industry in educational matters; a viewpoint which coincides with ours.

It is a matter of fact that courses in plastics are currently held in seven centres, the Borough Polytechnic, Acton Technical College, and the National College of Rubber Technology, in London, and at Manchester, Birmingham and Stroud. With the exception of Acton, which prepares students for the Associateship examination of the Plastics Institute only, all the others include courses in preparation for the intermediate and final City and Guilds examinations. At the intermediate examination held in the spring of this year 62 candidates sat, 31 passing. Not one of the successful candidates had undergone a full-time course, there being none available. Some benefited by part-time day release schemes; the rest took two to three years to achieve their goal by evening study.

By contrast the rubber industry, through the Institution of the Rubber Industry, examined 66 students in June for the Licentiateship examination, comparable in level with the final certificate of the City and Guilds. Of these a considerable number had taken a full-time three-year course. Amongst the centres for training in rubber technology, on a full-time basis, is the National College of Rubber Technology, built at the expense of the Ministry of Education, abundantly equipped with every facility for practical work, again at the

expense of the Ministry, and regarded by many educationalists as the foremost of its kind in the world. It owes its existence to agitation by the rubber industry for a specialist training centre and indeed the Percy Report, which was instrumental in bringing into being all the National Colleges, recognized the request of the rubber industry as justified.

Scientifically and technically our rubber industry is smaller and growing less fast than the plastics industry. In technical skill the two are comparable, with a slight bias in favour of plastics because of the multiplicity of polymers that are in use, and are undergoing development today. In terms of tonnage of products, rubber at first sight has the advantage, but the use of polymers in paints and textiles, and these must come under the heading of plastics technology even if they are not strictly part of the plastics industry, again equalizes the two industries.

We cannot see, therefore, that the rubber industry has any superior claim to ours for a National College; it has merely got there first. But it has got a steady flow of young men entering it who have had the benefit of full-time study. There are over 60 such students at the National College alone, studying for the Licentiateship and Associateship examinations of the Institution of the Rubber Industry, and carrying out post-graduate research; the numbers are increasing.

Can we deduce then that the existence of a really well-equipped centre stimulates student and management alike? Certainly the only real burden that has fallen upon the rubber industry as a result of the building of the National College is the provision of a number of scholarships and bursaries, and this has not proven too onerous. Psychologically we cannot imagine a better method of securing the interest of an industry in education than by erecting a fine college from which the same industry can obtain a supply of well-trained and qualified personnel, and in which valuable research can be carried out. It would be difficult to walk round a centre in the scale of the National College of Rubber without becoming enthusiastic.

It may now be impracticable to consider the setting up of a separate National College of Plastics Technology but already a nucleus of such a centre exists in the College of Rubber Technology. Already some 25 new students a year participate in the part-time three-year course, and this year several will commence post-graduate research studies. It should be possible to extend this, and perhaps to extend the National College building too, so that under one roof two units having a great deal in common from the technological standpoint could reap the full benefit of the organism.

There need be no question of charity in this, no question of plastics "tagging along behind as a poor relation." Public money paid for the National College, and we see no reason why the Ministry of Education would place obstacles in the path of its extension, provided that there was some demonstration of interest on the part of the industry.

This having been achieved, the cumulative effect that has been evident in rubber would surely follow. The plastics industry would have something to be proud of, as would the students. And in no sense would any of these proposals conflict with the present arrangements for study in plastics. There will always be a place for part-time education, which should be complementary to full-time studies.

Moulding Powder and Shot

The Cost of Change.

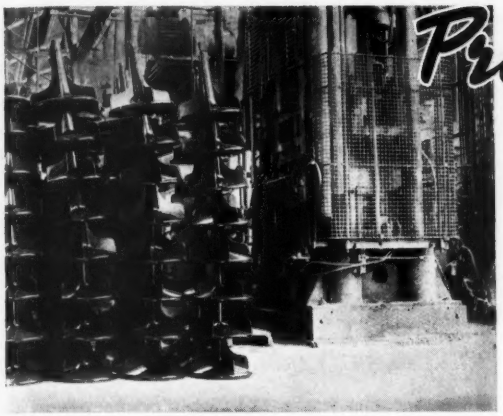
One of my wealthy friends who moulds for a living was recently bemoaning the cussedness of customers who midway in a production run decide to change the colour of large injection mouldings. Obviously colour is important, and the Sales Manager may have a good case for arguing that the public taste for, say, radio cabinets has changed and that the pale puce of Tuesday is no longer *de rigeur* for Wednesday. What he often does not realize, however, is the headache that these changes are to my moulding pals. On one type of injection machine a change of colour takes one hour and wastes 28 lb. of material. On another, a change takes 12 hours and production materials and labour losses amount to nearly £100. One of the worst jobs is to switch from clear polystyrene to clear acrylic; unless the cylinder is removed and cleaned, a silvered effect is obtained, and very decorative too, but definitely not appreciated by the moulder or his customer. And any change from coloured to clear material is a long, tedious and costly business.

◆ ◆ ◆

The Keys to your heart.

Have returned fit and bronzed (well, yellowish at any rate) from my favourite resort, Wapping Old Stairs—paddling and fishing free. No tarpon, but fished up an ancient British hotel key with the usual half-pound of cast iron attached to it and labelled Seaview Hotel, Burslem, Room 23. Of course at Old Ma Griggses place in W.O.S. we don't have keys, she's got the only one, but if you want tags, I think at least they ought to be a bit less weighty and a bit brighter than the one I picked up; they might also have a tasty bit of advertising on them. And what could be nicer than some "three-dimensional" work like the pretty designs now being turned out for automobile insignias on steering-wheel hubs in polystyrene.

DOGSBODDY.



Production Story

This "Production Story" is designed to illustrate the typical day-to-day work of a large moulding organization. To the customer and potential customer of the plastics industry it will explain some of the complicated operations which bridge the gap between the placing of a contract and the delivery of the mouldings. Although the moulding industry relies to a large extent on the principle of mass production, it is nevertheless a craft, and at all stages in the production of any given component a large number of highly skilled personnel are called upon to make use of their wide experience.

TWO million mouldings a week are produced at the Witton Moulded Insulation Works of The General Electric Co., Ltd. They vary in size from tiny switch dolleys to large radio cabinets and include components for cars, aircraft, telephone equipment, domestic accessories and numerous other applications.

Employing upwards of 1,200 men and women, the Witton moulding shop is one of the largest in the country. It incorporates compression presses with capacities ranging from 10 to 1,200 tons and injection machines with capacities from 1 to 32 oz. Materials moulded include phenolic, urea, melamine, polystyrene, cellulose acetate, nylon, polythene and various bituminous compositions.

Early History of Witton

In common with the plastics divisions of several other great industrial undertakings, Witton Moulded Insulation Works owes its beginnings to the need of the parent body for its own moulding service. In 1919 Mr. R. J. Kaula, the present general manager at the Insulation Works, joined the G.E.C., which had been moulding bituminous compounds for some years. Attention turned to the new composition patented only eight years before by Dr. Baekeland, and the company soon began moulding phenolic powders on a large scale. Since then the management has always kept closely in touch with new developments in materials and processes in both the thermosetting and thermoplastic field, and following the inception of injection moulding built up a large injection shop side by side with its continuous progress in compression and transfer moulding. Today the organization ranks historically as one of the oldest in the British plastics industry and brings 40 years of unrivalled experience to bear on its handling of moulding problems.

It is a far cry from the small layout of 1916 to the vast press shops, finishing and assembly lines, toolroom, drawing office and stores of today. The original works, however, was fortunate in being sited on the 280-acre Witton estate, so that there was plenty of room for expansion. This estate, owned by the G.E.C., has its own power station, fire brigade and police force, and contains several major G.E.C. units, including the heavy engineering works, transformer works, heavy switchgear works, battery works and a foundry. The Insulation Works was, therefore, able from the start to draw on certain central services which makes for efficiency of operation.

Besides meeting the moulding needs of the G.E.C. as a whole, the Witton Moulded Insulation Works provides a moulding service for industry generally, a valuable proportion of the total production being moulded for customers outside the G.E.C. An extensive advisory and design service is maintained, handling a multitude of products each year. The operation of this service can best be illustrated by describing a typical undertaking, such as the production of mouldings used in the Servis model washing machine made by Wilkins and Mitchell, Ltd.

Mouldings for Washing Machines

Wilkins and Mitchell, Ltd., wished to replace the light-alloy agitator used in one of their washing machines with a moulded unit. Following a visit by a G.E.C. salesman, they decided to approach the Witton Moulded Insulation Works. Samples of the light-alloy unit were passed to the design staff at the Insulation Works. The various possibilities were discussed, and outline drawings of an equivalent moulded unit were prepared and submitted to the customer, who after minor modifications passed them as satisfactory. These draft drawings were thus the outcome of close liaison between works and customer: the works with its extensive moulding experience evolved a design that was suitable for quantity production and met the customer's requirements. At the same time representatives from Wilkins and Mitchell, Ltd., were able to tour the Witton Works and see for themselves the moulding and finishing facilities available.

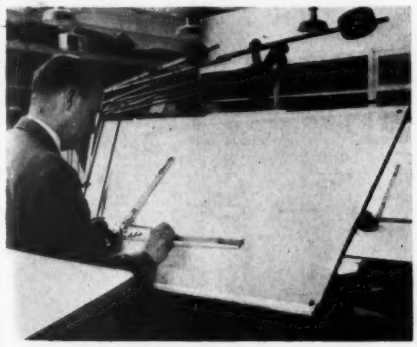


Fig. 1 (left).—Tool drawings for the washing machine agitator are prepared by a draughtsman.

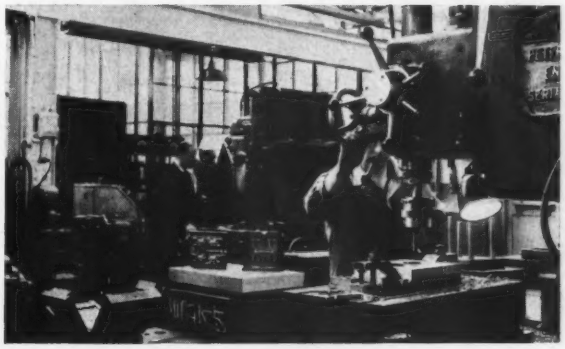


Fig. 2 (right).—A view of the toolroom at Witton.

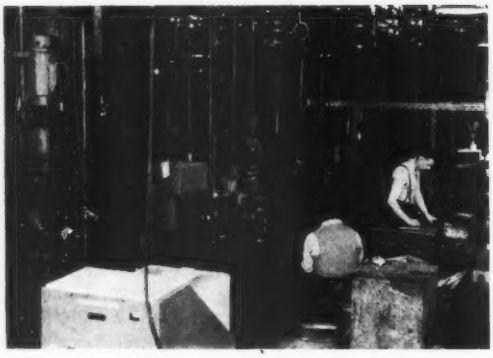


Fig. 3. A bay of the main moulding shop.

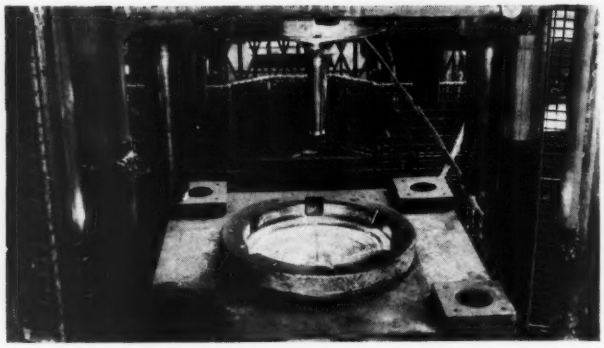


Fig. 4. Punch and die for agitator moulding.

Side by side with these discussions, moulding specialists settled such points as the grade of material to be used, the production rate obtainable, the cost of the tool and the cost of moulding. As is common practice in the moulding industry, the cost of manufacturing the tool was borne partly by the customer and partly by the moulder. The customer's proportion ensures that production from the tool is reserved exclusively for the customer's own requirements and that the tool is kept in good order by the moulders.

Generally speaking a customer will accept a moulder's advice as to the most suitable material for any given moulding, but there is an increasing tendency for customers to specify materials which are either unsuitable or, more commonly, unnecessarily expensive. The moulder has to use considerable discretion sometimes to dissuade a customer from specifying a material which will lead to difficult moulding conditions. He cannot simply act on the principle that the customer is always right. In the case of the agitator, however, the Bakelite X13080 detergent resistant grade of phenolic was selected at once.

Tool Manufacture

Following the acceptance of the drawings, the tool room produced the mould. A section of the tool room can be seen in Fig. 2, a Keller profile milling machine used for this type of work being seen in the centre background. In view of the depth of the four vanes on the agitator, the die was constructed on the composite principle, since it would be impossible, using conventional plant, to mill the narrow blade cavities. The design also required a cast-alloy lug moulded in to the finished agitator; for efficient operation it was clearly essential that this should be concentric with the outside rim of the moulding. To ensure accurate concentricity it was decided to locate the lug in the bottom of the die by means of a removable insert pin.

When the mould was completed, it was given a preliminary run and sample mouldings were sent to the customer for approval. Production was then put in hand. A general view of one of the press bays in the Witton Moulded Insulation Works is shown in Fig. 3. As already mentioned the press capacities range from 10 to 1,200 tons. For moulding the agitator a downstroke Berry press of 800 tons capacity was used. Fig. 4 shows a close-up of the mould in this press. A carrier pin is used for locating the alloy lug at the bottom of the tool. The carrier pin is removed after withdrawal of the moulding and the moulding is then roughly deflashed by the press operator. Finally, before dispatch from the works, the agitator is treated with a rotary trimming tool (Fig. 5). An operator, wearing a mask to protect him against the dust, passes a pneumatic-operated buff up and down the edge of the vanes.

Three different types of switch moulded and assembled by Witton Moulded Insulation Works are incorporated in the Servis range of washing machines. Two of them are standard Mutac lines, but the third was devised specially for the Servis model washing machine and the complete switch together with its constituent parts can be seen in Fig. 6; the mouldings comprise a base-plate, cover and dolley.

The Witton Moulded Insulation Works has devoted particular attention to the moulding and assembly of switches and produces about 3 million switches a year, including the well-known Mutac range which was developed at the works. Special arrangements have been made for moulding the many small components required on a large enough scale. The base of the special switch devised for Wilkins and Mitchell, Ltd., is moulded in a conventional multi-impression tool (Fig. 7), but the dolleys are produced in small bench hydraulic presses operated by female labour. These presses are equipped with ingenious multi-impression tools, which, operated in conjunction with simple mechanical devices, enable a remarkably high production rate to be attained; operations such as opening the tool, deflashing the moulding and replacing the

Fig. 5. Trimming the agitator.

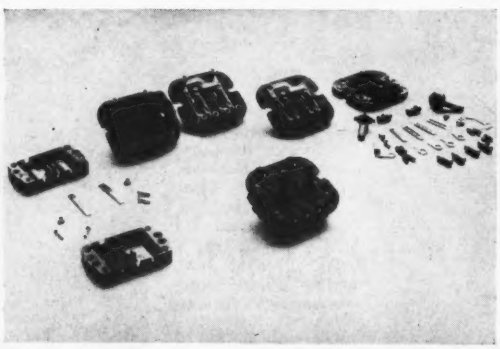


Fig. 6. Components for switch.

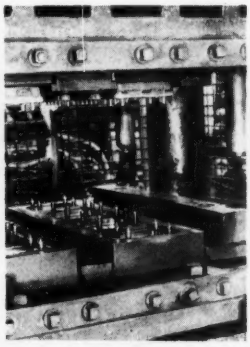


Fig. 7. Switch tool.

Fig. 8. Removal of dolleys.

Fig. 9. General view of assembly shop.

tool are greatly simplified. Fig. 8 shows a line of moulded dolleys being removed from the tool in a device of this kind.

Switch Assembly

Assembly is carried out in a department given over exclusively to this work and here again there are numerous mechanical aids. In fact, the works probably leads the field in small-part assembly of this kind. Fig. 9 shows a general view of the assembly shop, which uses female labour throughout. Fig. 10 shows a close up of a typical operator's layout in this shop. The moulded base-plates are drawn from the tray at the left, while the brass contact strips to be assembled are accommodated in the well in the foreground. The components are located in a jig and the power-operated machine butts these strips into position, the unit then being passed along the line to the next stage.

Injection Moulding Nylon

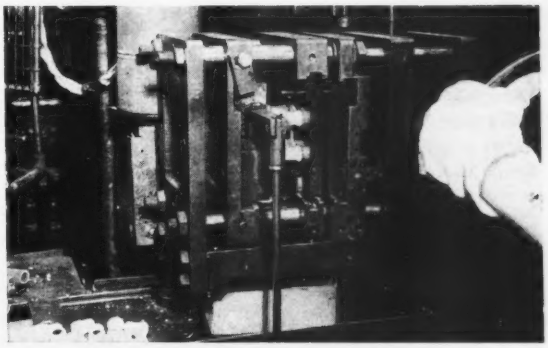
A third unit contributed to the Servis washing machine by the G.E.C. is an injection moulded nylon bush. This is produced in the same bay as the switch dolley, a similar arrangement being used. The moulding is carried out on a vertically operated hydraulic press. After moulding, the electrically heated pot is swung clear, the tool is transferred to an unloading device (Fig. 11) and the moulding is removed. Nylon was chosen for this component because bearings in this material will run satisfactorily in water without any other lubrication; in addition, of course, it is especially resistant to wear and is unaffected by the temperatures obtained in machines of this kind.

Another component moulded by the G.E.C. for the Servis washing machine is the wringer guard. This is injection moulded in polystyrene in the main injection shop seen in Fig 12. To the right of the picture can be seen part of a 32-oz. H.P.M. machine, with the tool open, being prepared for the moulding of breaker strips for refrigerators. The wringer guard, shown in Fig. 13, is hand wrapped in tissue paper immediately after moulding to eliminate the collection of dust by static electricity. Current washing machines in this range are now, however, incorporating a steel guard.

The writer wishes to thank the technical staff at Witton for the help afforded him in the preparation of this report.

Fig. 10. (Left) Switch assembly.

Fig. 11. (Right) Injection moulding nylon bushes for the washing machine.



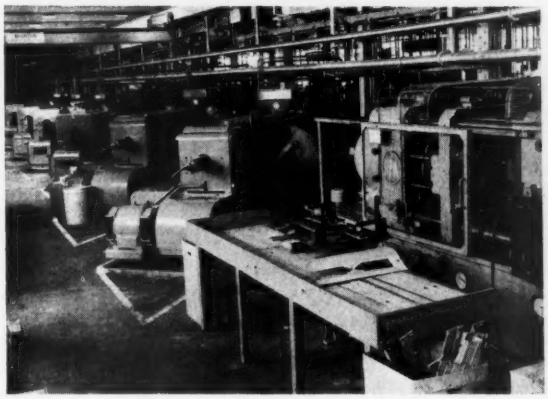


Fig. 12. (Left) General view of injection moulding shop.
Fig. 13. (Below) Wringer guard moulded in styrene.

Plastics Widely Used in New Commercial Vehicle

A report on the construction of the Reliant 5-cwt. Light Van

Fig. 1—Reliant van nearing completion.

ONE of the sensations of the Motor Show of last year was the Singer all-plastic car body. Although an admitted experiment it provided many with food for thought. At that time, and since, much publicity has also been given to the American Corvette body, in production to an estimated figure of 50,000 per year. This latter development was in fact discussed at length in an exceedingly well-written and well-informed article in *Fortune*, "New Chance for Glass-in-Plastic," subsequently reprinted in the June issue of *Plastics*.

The controversy that has ensued is not so much the question of whether or not a car body can be made in plastic materials, but whether there are advantages, economic or structural, from so doing. On the Corvette scale, *Fortune* concluded that there were not. The argument discussed was one of considerable sense to all who have had experience of glass-fibre polyester resin structures. It was, that at the present level of development, repetitive units in glass-fibre are slower to make, require more factory space and are more costly per unit, when the demand is greater than 15,000 units. This seemingly arbitrary figure is in fact the result of calculations by General Motors, and takes into account the rapidity with which car bodies can be produced in clearing presses from rolled steel sheet.

If these widely accepted calculations are correct, we may safely assume that a case exists for the production of vehicle bodies provided that an upper limit not greater than 15,000 is envisaged. Until now, nobody in this country has set out to prove this theory correct or fallacious.

This year's Commercial Motor Show, which opened in London on September 24, was remarkable if only because of the Reliant 5-cwt. van, which offers a convincing argument in favour of the above theory.

The Reliant Engineering Company (Tamworth), Ltd., are perhaps in a unique position to test its validity. For many years the company has specialized in the manufacture of three-wheeled vehicles, particularly the popular Reliant car. Powered with a four-cylinder 4 h.p. engine, and as complete as the normal car in every detail, the three-wheel structure has a very substantial following from enthusiasts, plus substantial economic advantages for the man who wants cheap motoring. The annual tax is £4 10s., compared with £12 10s. for four-wheeled cars, and petrol consumption is as low as 50 miles per gallon. Although built for a small market when compared with conventional vehicles, there is nevertheless an urgent need to keep costs down, as distinct from the fast and high-powered sports car where price is frequently regarded as being of secondary importance.

The conditions of manufacture are therefore contradictory to those which apply to the popular cars, viz., low cost with small production, against low cost with large production. Clearly then, pressed bodies are out of the question.

Until recently, therefore, Reliant have used panel-beaten light alloy, an extremely expensive but hitherto unavoidable procedure.

The first venture into glass-fibre structures was the replacement of the aluminium engine cover and propeller shaft tunnel of the Reliant Regal three-wheeler car with glass-fibre mouldings. Covered with fabric, seen in Fig. 2, these components are found to be roughly half the cost of aluminium, and greatly superior in resistance to damage.

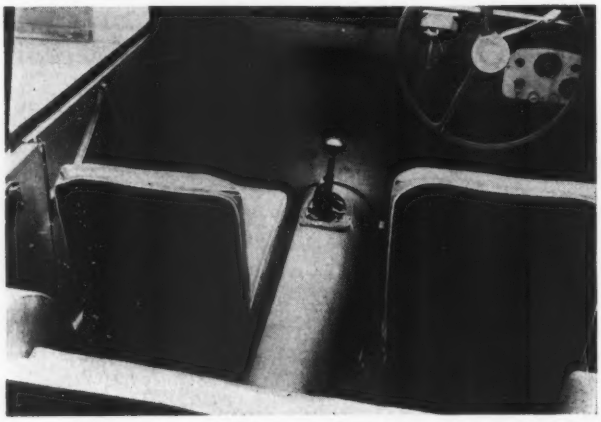


Fig. 2—Engine cover and propeller shaft tunnel in glass fibre.

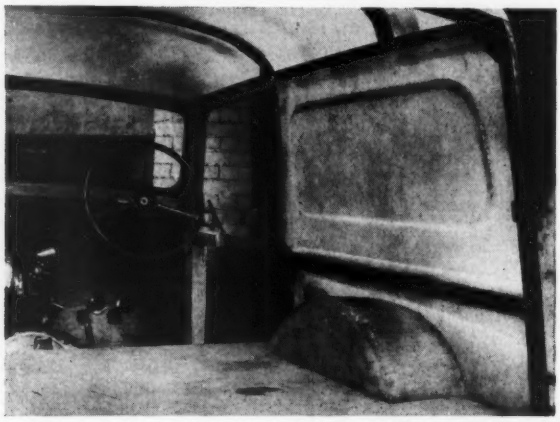


Fig. 3—Interior view of van showing side and roof in laminated material.

Fig. 4. (Left) Wooden tool for side panel, from which the mould was made, in glass fibre, for the side shown in Fig. 6.

Fig. 5. (Right) A panel immediately after removal from mould. It has not yet been completely trimmed.

The introduction of a light van based on the Regal chassis was already then projected for the 1954 Commercial Motor Show and success with the application of glass-fibre to these parts decided the company to build the body of the van largely of the same material, employing polyester resin manufactured by British Industrial Plastics Ltd.

Fig. 3 shows a rear three-quarter view of the van nearing completion. Roof, sides, and rear panel have been fabricated in glass-fibre bonded with polyester resin. Each side unit incorporates the wheel box.

To fabricate these components from light alloy would require many hours of panel beating, and Reliant Engineering are convinced that their new technique offers them substantial economic advantages. There are also structural advantages which are worthy of consideration.

In Fig. 4 can be seen the tool for one side panel, with the recess at the bottom right-hand corner for the petrol-filling pipe to the tank. The tool was constructed from wood and was reasonably cheap to manufacture. In Fig. 5 is a view of the panel immediately after removal from the mould, and untrimmed. In Fig. 6 can be seen the assembled units including the side panel which has now been mounted on the wooden frame, having been welded into position on the frame by further application of glass-fibre and polyester resin. Thus the glass-fibre structure and the wooden frame reinforce one another and the result is a very strong construction. A similar technique is used for the moulding of the roof, which can also be seen in Fig. 3.

The plastic body panels and other components are based on chopped strand material weighing 2 oz. per sq. ft. The moulds are of the same material, shaped on wooden formers, with a high finish, which imparts a smooth surface to the interior of the mould and therefore to the exterior of the panel. After the application of a parting agent, sodium alginate, the mat is treated with a bonding resin polyester, which is brushed on, and is then gently squeezed onto the mat with a multi-segment hand roll. The setting of the resin takes 1½ to 2 hours in a warm room, and the panels are sufficiently hard for working in about two days. A fully-hardened condition is reached in a week. The body framework is of hard wood and each section is bonded, as mentioned above, to the glass-fibre before it is set.

The frame comprises four main pillars and conventional cant rails, waist rails, sectioned floor rails and roof sticks. The panels are joined by pop-riveting or by common attachment to the wood members with screws. The wheelboxes are bonded to side panels, which incorporate rectangular shaped wings of modern design, and are fixed with wood screws to a plywood floor. The exterior surfaces of the panels are mechanically polished before being painted. The total weight of the body is comparable to that of an aluminium-panelled coachbuilt type, and the estimated cost saving with regard to the panels, individually, is about 50%, depending on the degree of shaping required. All the moulding is performed in the Reliant workshops.

In view of the success the company has achieved with the 5-cwt. van, it is most likely that the Regal three-wheel car will also be fitted with a glass-fibre body. The use of this material places Reliant in the position of being able to effect major modifications in design quickly and without incurring expensive tool costs, in addition to the advantages already noted above.

Fig. 6. Assembled unit. The rear panel below the doors is also in glass fibre.

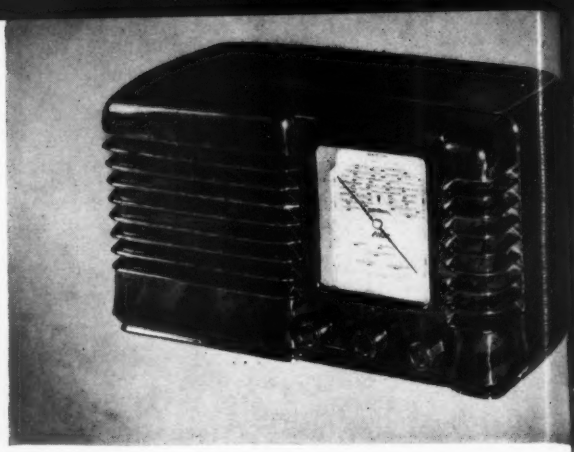
K

PLASTICS
IN THE SERVICE OF MAN

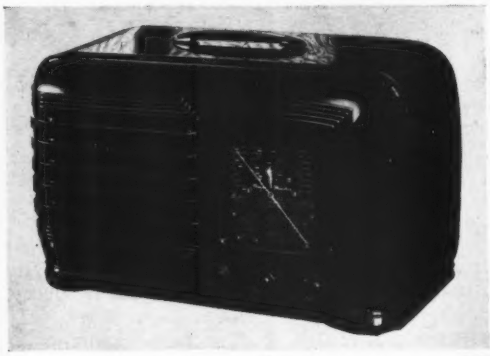
A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

52.—Radio and Television

A list of trade marks and companies mentioned in this review, with full names and addresses, appears on page 241.



(Above) 1939 model of Pilot Little Maestro with moulded cabinet in phenolic material.



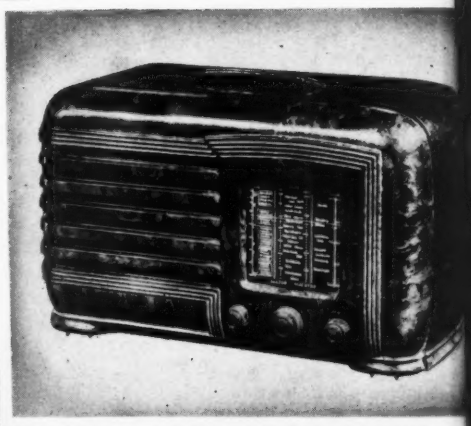
(Above) Pre-war model of Pilot Major Maestro with cabinet of moulded phenolic material.

(Below) A 1930's version of the Pilot Major Maestro. Cabinet of moulded phenolic material, reproducing a wood grain effect.

(Above) Ekco model 74 produced in 1933/34 and moulded in phenolic material.

THE OLD. . .

(Below) Marconiphone Baby Crystal set, manufactured in 1924, probably the first moulded plastic radio set, by British Moulded Plastics Ltd.



(Below) The Bullaphone loudspeaker of the late 1920's. The base and lower sections were moulded in phenolic material by British Moulded Plastics Ltd.

(Below) An early Ekco receiver model A.C. 86 with moulded cabinet.

(Above) Pre-war Ekco model BV78 with moulded cabinet in black phenolic material.

(Left) Murphy model T.A. 222; cabinet moulded in maroon phenolic material. Scale in clear acrylic.

(Below) Murphy model U.198; cabinet moulded in maroon phenolic material.

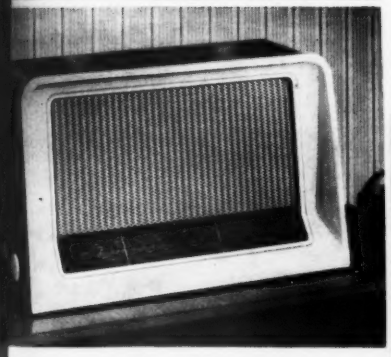
(Above) Bush model DAC10; cabinet moulded in brown figured phenolic and knobs in urea.

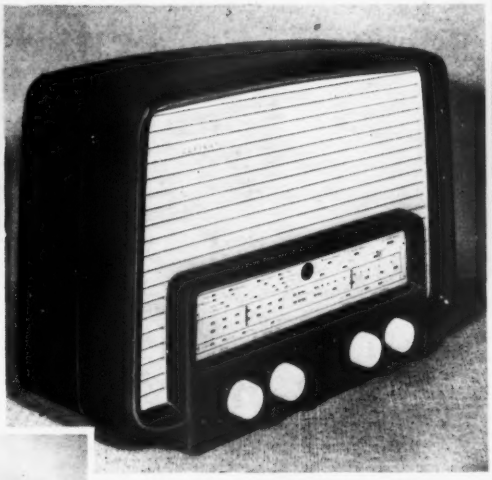
(Below) Murphy model A.192; cabinet moulded in dark brown phenolic material.

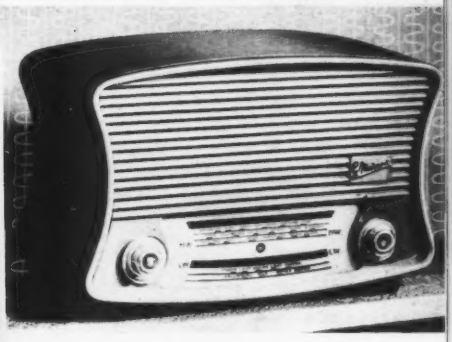
(Right) Pye model P65 MBQ; front and back of the cabinet are injection moulded in polystyrene.

AND THE NEW

(Below) C.W.S. Defiant model MSH 555 A.C. cabinet moulded in phenolic, grille and knobs in urea.







(Above) H.M.V. model 1125; front escutcheon moulded in standard phenolic material sprayed cream.

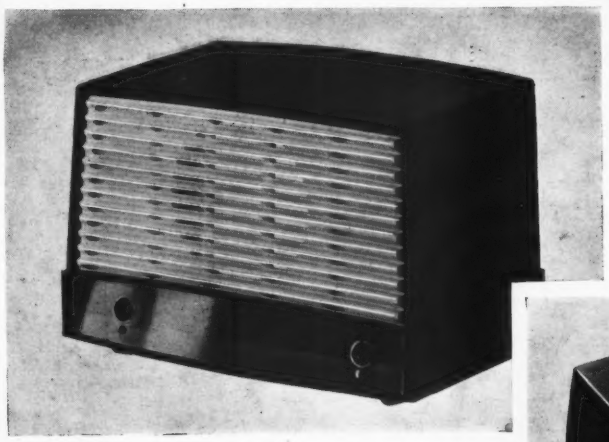
(Above) Marconiphone model T37 DA; cabinet moulded in maroon phenolic material.

(Left) H.M.V. model 1360; moulded cabinet in phenolic material, with injection moulded polystyrene panel. Both mouldings by National Plastics (Sales) Ltd.

(Right) Pye model P93U; cabinet moulded in phenolic material.

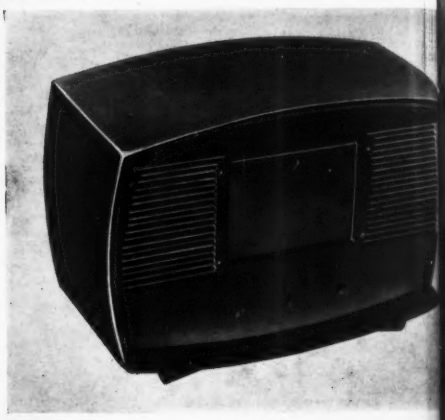
(Left) Cellulose acetate butyrate case for Kolster Brandes Ltd., moulded by Injection Moulders Ltd.

(Right) Front panel for Ultra, moulded in thermoplastic material by Injection Moulders Ltd.



(Right) Philco cabinet moulded by National Plastics (Sales) Ltd., in phenolic material with thermoplastic grille.

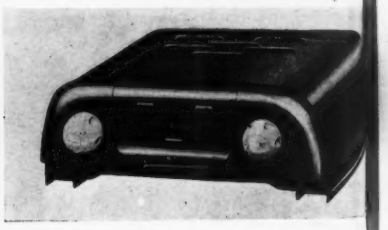
(Below) Radio cabinet moulded in phenolic material by Birkbys Ltd.

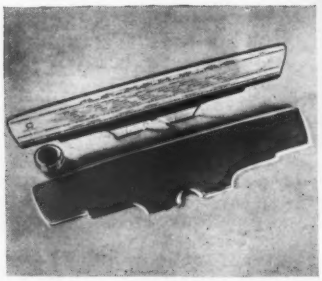


(Below) Radio cabinet moulded in phenolic material by Birkbys Ltd.

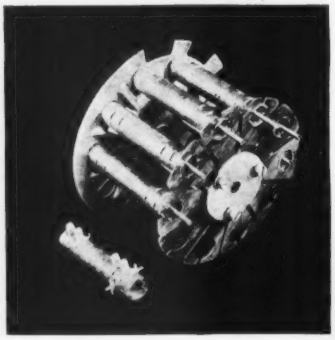
(Below) Urea moulding by National Plastics (Sales) Ltd., for Bush Radio.

(Below) E. K. Cole Ltd. car radio with moulded front panel in polystyrene.

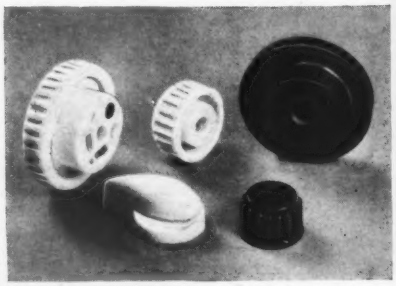




(Right) Tuning scale in acrylic and moulded polystyrene tuning knob by Punfield and Barstow (Mouldings) Ltd.



(Below) E. K. Cole U215 receiver with moulded cabinet in polystyrene.



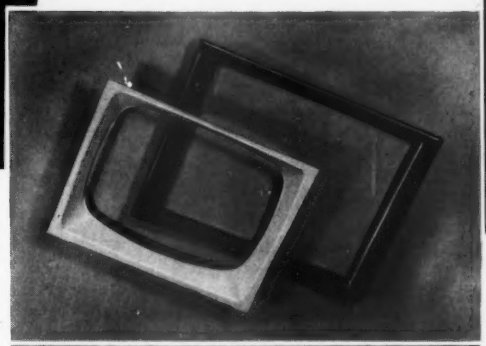
(Right) Radio and television control knobs moulded by Barclay-Stuart (Plastics).

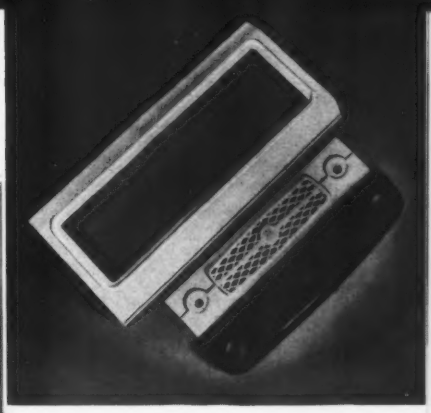
(Above) Paxolin former for G.E.C. Co. Ltd., manufactured by The Micanite Insulators Co. Ltd.

(Left) Control knobs and anti-corona mounting in polystyrene moulded by Injection Moulders Ltd.

(Above) Pilot "Little Maestro." Cabinet, knobs and handle moulded in polystyrene.

(Below) Regentone moulded television screen frame and surround in polystyrene.

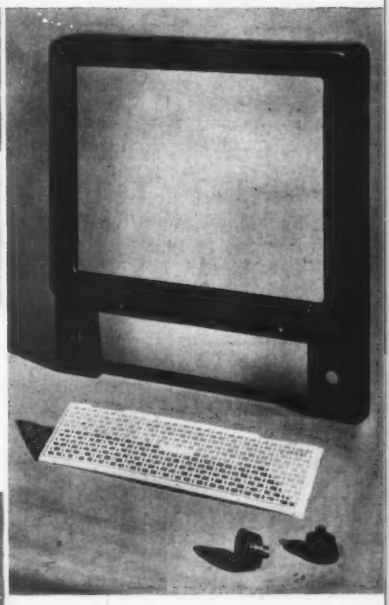




(Above) Regentone moulded control panels and surround in polystyrene.

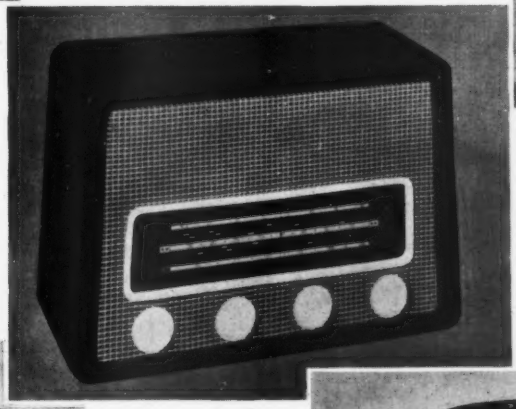
(Below) Pilot Radio model T.85. Cabinet and knobs moulded in phenolic material, speaker grille in polystyrene.

(Above) Bush television. The first moulded T.V. cabinet in this country, moulded by National Plastics (Sales) Ltd., in phenolic material.



(Above) Cossor television screen surround, control knobs and grille, moulded in polystyrene.

(Right) Radio and Allied Industries Ltd., model 515P with moulded cabinet.



(Below) Ultra Troubadour receiver. Cabinet and knobs moulded in urea by National Plastics (Sales) Ltd.

(Right) Philips, model 141U. The cabinet is moulded in phenolic material, the tuning scale and knobs are in polystyrene.

Farnborough 1954 Show Reviewed

A record of the contribution of plastics to the construction and fitting-out of aircraft, shown at the 15th display of the Society of British Aircraft Constructors.

THE first exhibition organized by the Society of British Aircraft Constructors was held in 1920 at Olympia, London. In those days the application of plastics to aircraft was limited to a very small quantity of mouldings plus the synthetic dope, based on cellulose acetate, which was used to proof aircraft fabrics. In 1932 the S.B.A.C. exhibition took place at Hendon Aerodrome, coupled with a flying display. Already great changes had taken place in aircraft construction. The wood and piano wire of the very early aircraft had been replaced by light metal structures. However, ten years after the first display the part that plastics played in the construction of the average aircraft was still very small.

Last month, at the 15th S.B.A.C. Show at Farnborough (no displays took place between 1938 and 1945) the importance of plastics in aircraft was no longer in doubt.

Reporting the 1953 Show in the October issue last year we drew attention to some of the many interesting developments; the majority of them were of a prototype nature which were on view then. In a great many of these developments, within the space of one year, the emphasis has changed from prototype to production work.

The following pages will convey to the reader the true significance of synthetic materials in modern aircraft industry. This is particularly true of the structural materials, fibre-glass and asbestos.

Structural Materials

Turner Brothers Asbestos Co., Ltd.

Four materials suppliers, Turner Brothers Asbestos Co., Ltd., Fibreglass Ltd., Fothergill and Harvey (Sales) Ltd., and Bakelite Ltd., had stands on which to show their products, together with examples of units fabricated from these products. Turner Brothers have for some considerable time specialized in the field of asbestos mat, impregnated with a phenolic type resin, marketed under the trade name, Durestos. They have recently expanded the scope of their activities to incorporate a glass cloth manufacturing organization, the products of which are marketed under the trade name Duraglas. In Fig. 1 can be seen three examples of products fabricated from Durestos. On the left is a large scale piece of ducting, manufactured by the Bristol Aeroplane Co., Ltd., on the right is a hood fairing manufactured by Marston Excelsior Co., Ltd., and above can be seen part of a radar scanner by Cossor Ltd. All three units are constructed from Durestos, employing the hot cure technique, under relatively low pressures, and all demonstrate the versatility of asbestos-reinforced materials for constructional purposes.

In Fig. 2 are shown samples of Duraglas, ranging from glass cloth to glass tape, and on the left several examples of units fabricated from these materials. They include a radome manufactured by the Fairey Aviation Co., Ltd., a storage box manufactured by the Bristol Aeroplane Co., Ltd., aircraft aerials manufactured by Chelton (Electrostatics), Ltd., and fuel tanks manufactured by Fireproof Tanks, Ltd. Fig. 3 is a close-up photograph of woven roving in the glass material which, as a new form of reinforcing agent, has achieved great interest. Amongst companies using plastics reinforced with this material are Pressed Steel Co., Ltd., and Briggs Motor Bodies Ltd. A considerable future appears open to these materials by virtue of the great compression strength which can be obtained, making them eminently suitable for pressed tools. At the moment, the limitation of their application is mainly one of resin, since normal polyesters tend to disintegrate under continued high impacts. Experiments are being carried out with alternative resin bonding agents such as resins of the epoxy type in the hope that the resin itself will achieve a durability comparable with that of the glass cloth. These structures have therefore a twofold interest to the aircraft engineer. They offer important advantages in structural applications and in addition may well have a considerable future in the field of pressed tools.

Fothergill and Harvey (Sales) Ltd.

On the stand of Fothergill and Harvey (Sales) Ltd., were shown components manufactured from the company's glass yarns and fabrics marketed under the trade name Tyglas. In Fig. 4 is shown samples of tubing and sheets manufactured by Semtex Ltd. Amongst weaves which are obtained from Fothergill and Harvey are plain weaves, twill weaves and satin weaves. It is interesting to compare the tensile strength of glass fabrications, with for example, cotton and wool. Glass will give a tensile strength of between 204,000 and 220,000 lb. per sq. in. For cotton a figure would be in the order of 124,000 lb. per sq. in., and for wool, 29,000 lb. per sq. in. These high strength factors are coupled with heat, weather and chemical resistance.

Fibreglass Ltd.

Fibreglass Ltd., were the pioneers in the glass cloth field. Fig. 5 shows a propeller spinner moulded in polyester glass-fibre laminate for a Beverley Freighter; it was made by the vacuum bag technique and has been in use during 90 hours' flying. This photograph demonstrates very clearly the complex structures that can be achieved with the aid of this material. Fibreglass Ltd., reported extensive interest in their products since the last Farnborough Show, and, as will be

seen later on, much of the development work which has been done with their materials is now taking place on a production scale amongst companies connected with the aircraft industry.

Bakelite Ltd.

Exhibits shown in reinforced plastics included parts of two radomes made from glass fabric bonded with Bakelite polyester resins; one with a Dufaylite honeycomb core of the same materials, the other with a Hycar expanded rubber core. Both of these constructions are claimed to provide the combination of strength, light weight and easy fabrication required for such parts. Other items on the stand included an aircraft battery box, a helmet and piping, and several smaller units in reinforced material.

Ashdowns Ltd.

A large number of companies were showing products fabricated with the aid of the materials supplied by the companies mentioned above. For example, Ashdowns Ltd., had a range of mouldings, four of which were of special interest, but still on the secret list so far as application is concerned. Fig. 6 shows these four units. The unit in the left foreground is a sandwich construction of woven glass fibre with Nuron resin, with an expanded ebonite core. In the right foreground is a component of woven glass fibre/polyester construction. The two objects at the rear were constructed from preformed chopped glass fibre bonded with a polyester resin.

Marston Excelsior Ltd.

Marston Excelsior Ltd., displayed three very important and interesting units. Fig. 7 is a glass fibre/polyester laminated drop tank. Fig. 8 shows a hood fairing moulded in Durestos for the Swift aircraft. In Fig. 9 is a fuel tank moulded in Flexelite material.

Thermo-Plastics Ltd.

On the stand of Thermo-Plastics Ltd., was shown a fine example of a glass fibre radome with an expanded rubber core, shown in Fig. 10. Thermo-Plastics Ltd., have recently found it necessary to expand considerably their plant at Dunstable to take the additional projects resulting from early development work in this field. Amongst the plant used by the company are Turner Atherton preforming machines and the Daniels fibre-glass press.

Shackleton (A. V. Roe and Co., Ltd.)

Two aircraft in the static exhibition were of special interest. The first was the Shackleton bomber, seen in Fig. 11. The bulge below the fuselage is a fibreglass moulding, housing radar equipment.

Beverley (Blackburn and General Aircraft Co., Ltd.)

The Beverley transport, shown in Fig. 12, is capable of carrying a plane-load of 22 tons. Shown last year, this aircraft is now equipped with extensive fibre-glass ducting, seen in Fig. 13. In Fig. 14 can be seen the inside of the caravan, more properly a mobile workshop, an exterior view of which was shown in Fig. 12. This has a special interest to the plastics industry in that it contains a Windsor extruder and is designed to be airlifted to aerodromes and military establishments so that piping can be manufactured on the spot, up to 6 in. interior diameter, for conveying water, for sewage systems, and for petrol piping. It is claimed that this is the first mobile plastic pipe-making machine. The total weight of the complete workshop plus motor bogie is 12 tons, and the total length is 37½ ft.

Acrylic Components

Thermo-Plastics Ltd.

Last year's exhibition was notable for two canopies, both for the Hawker Hunter fighter. As last year, Thermo-Plastics Ltd., again showed a canopy in ½-in. Perspex, seen in Fig. 15. Of all forms of Perspex fabrication, the manufacture of these canopies is probably the most intricate. The cost of such a canopy is in the region of £150 and great responsibility rests both upon the raw material supplier and the fabricator. Although Perspex is a material having excellent optical properties, when cast in sheets of ½ in. thickness, the question of internal stress is one of significant importance. When this is coupled to the actual moulding process which again can be responsible for considerable stress unless expertly carried out, it will be realized that the overall production is one that

(*Text matter continues on page* 330)

Fig. 1. (Left) Fabrications in Durestos by Turner Brothers Asbestos Co., Ltd.

Fig. 2. (Right) Components in Duraglas by Turner Brothers Asbestos Co., Ltd.

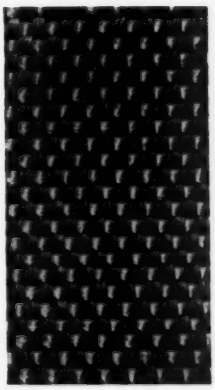


Fig. 3. (Right) Close-up of woven roving, Duraglas, manufactured by Turner Brothers Asbestos Co., Ltd. Photo by courtesy of Short Brothers and Harland Ltd.

Fig. 4. (Left) Samples of tubing and sheets fabricated from Tyglas, a product of Fothergill and Harvey Ltd.

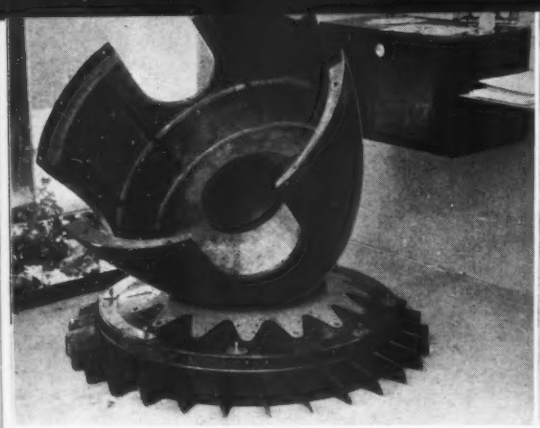


Fig. 5 (Above) Propeller spinner in Fibreglass.

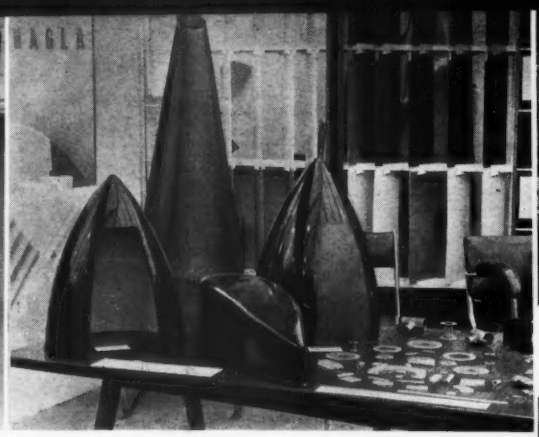


Fig. 6 (Above) Glass fibre structure by Ashdowns Ltd.

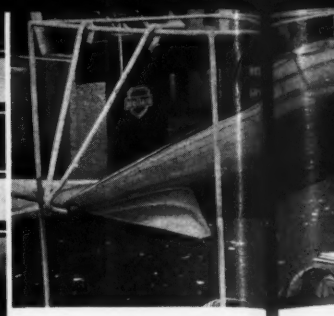


Fig. 7 (Above) Dropleton Exc

Fig. 10 (Above) Glass-fibre radome by Thermo-Plastics Ltd.

Fig. 11 (Above) Glass-fibre radome on the Shackleton.

Fig. 12 (Above) Mobile extru nters B

FARNBOROUGH 1954

Fig. 17 (Below) Acryli nts by

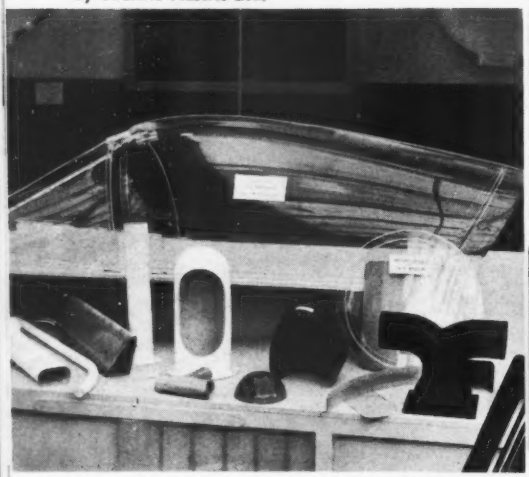


Fig. 15 (Above) Hunter canopy by Thermo-Plastics Ltd.

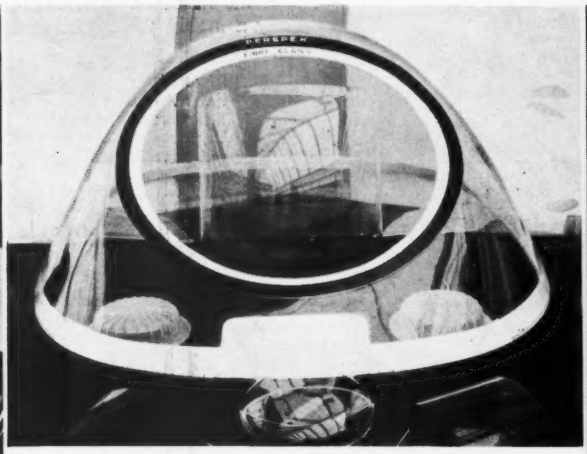


Fig. 16 (Above) Acrylic and glass-fibre structure by Suntex Ltd.

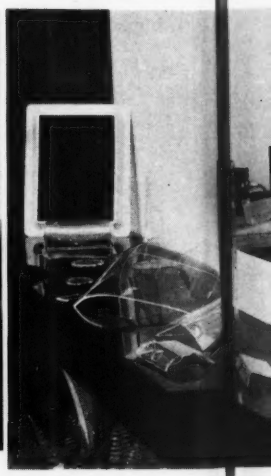
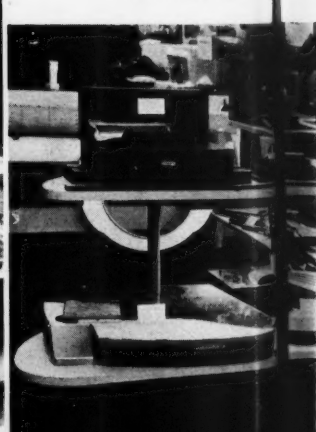
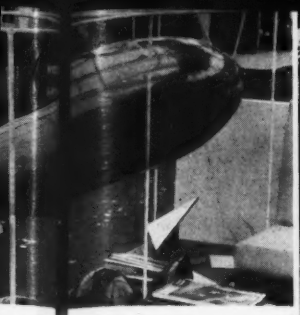


Fig. 22 (Below) Horder Richmond Ltd.

Fig. 20 (Below) Bakelite Ltd.

Fig. 21 (Right) Test jig in Tufnol.





) Dropston Excelsior Ltd.

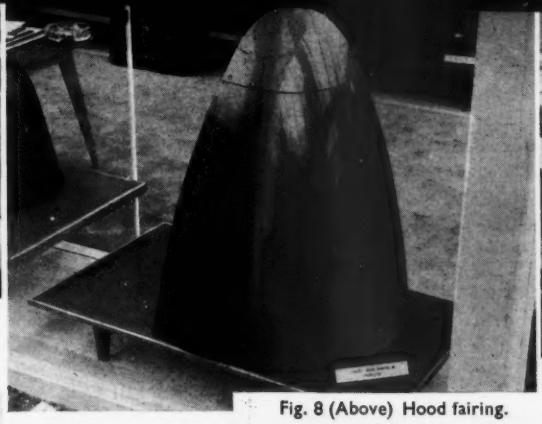


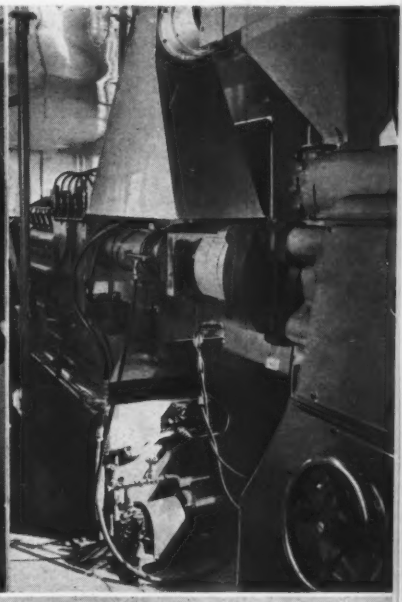
Fig. 8 (Above) Hood fairing.

Fig. 9 (Above) Marston Excelsior fuel tank.

Fig. 14 (Below) Interior of mobile workshop.

extruders Beverley freighter.

Fig. 13 (Right) Glass-fibre ducting in Beverley.



Acrylic nts by Attewell Ltd.

Fig. 18 (Above) Hunter canopy by Triplex Ltd.

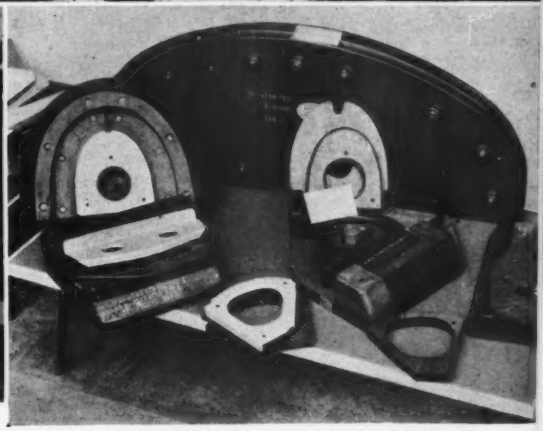
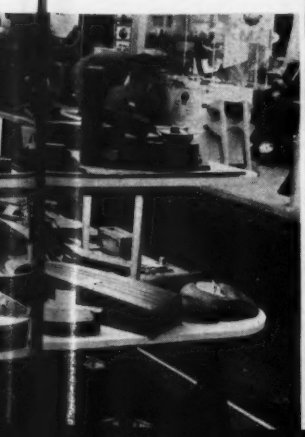


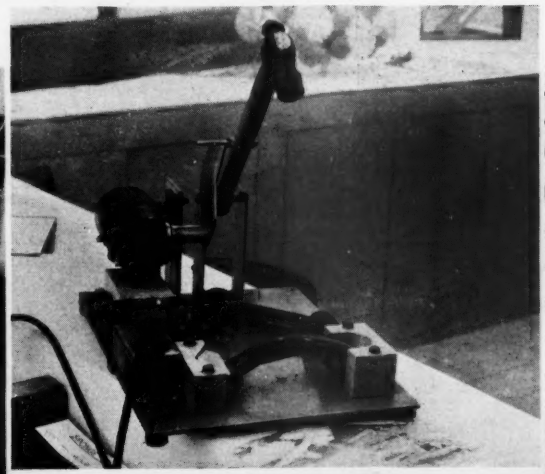
Fig. 19 (Above) Jigs and tools by Bakelite Ltd.

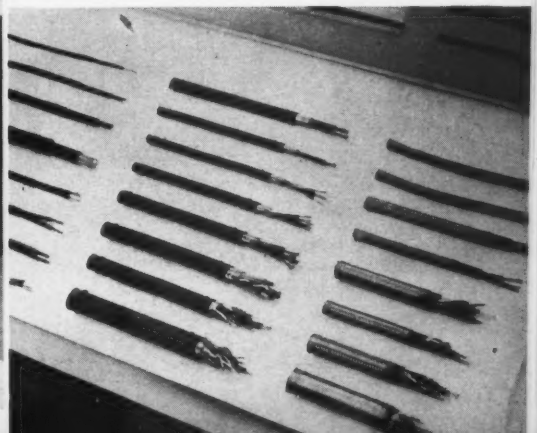
Fig. 24 (Below) Specimen cables on B.I.C.C. Stand.

ordered.

Fig. 23 (Right) Wallington Weston & Co., Ltd.







(*Continued from page 327*)

must be carried out with extreme caution. Fig. 15 shows clearly the taper between the leading edge of the canopy and the pilot's viewpoint when looking directly forward, and means that his vision is passing through the canopy at a very narrow angle. Any strain would result in the distortion of view, which, at high speed flight, could have fatal results.

Suntex Safety Glass Industries Ltd.

Acrylic materials have long been popular with the aircraft industry, partly because of the optical properties they possess, and also because of the lightness in weight. On the stand of Suntex Ltd., a blister was shown, seen in Fig. 16, the main structure of which was Perspex, the periphery of the hole in the middle being reinforced with fibre-glass. This conjunction of Perspex with fibre-glass has also been used in canopy construction. The advantage lies in the fact that the bolting of any Perspex structure to metal units can be a difficult task, greatly simplified if the actual point of bolting is constructed of glass fibre instead.

B. Attewell and Sons Ltd.

On the stand of Attewell, small components from Perspex were shown including light covers, shown in Fig. 17. In Fig. 18 can be seen a canopy for the Hawker Hunter, this time moulded by Triplex Safety Glass Co., Ltd.

Jigs and Tools

The problem of jigs and tools for the aircraft industry is one which has been much discussed almost since the commencement of the aircraft industry itself. The changing pattern of aircraft structures, coupled with the relatively small numbers manufactured, means that jigs and tools constitute one of the greatest charges to the industry. It has been the aircraft designer's dream to see the advent of a material which would enable him to produce low-cost and easily modified tools capable of being used with the light metal constructions common in his industry. To a very large extent, the plastics industry has been able to satisfy this demand. From the raw material side, Bakelite Ltd., have undertaken extensive research into the use of their resins and laminated materials for conversion into both jigs and tools. An extensive range of these products, together with samples of components made from them, was shown on the Bakelite stand, including tools for forming aileron nose ribs, and an intricate tool for forming aluminium wash-basins. Some can be seen in Fig. 19 and 20.

The materials which have mainly been used are impregnated wood, laminated wood, and laminated fabric and paper. All four of these materials offer high compression strengths. A further development has been the introduction of fibreglass. In this field, the compression strengths obtainable may very possibly reach 20,000 to 40,000 lb. per sq. in. The resin binder which is used with fibreglass, however, is normally of the polyester variety and it has been found that the sustained use of these tools has caused the breakdown of the resin. As mentioned earlier, research is now being directed towards the use of epoxy and other resins which may be found to have a greater resistance to continuous impact.

Tufnol Ltd.; Hordern-Richmond (Sales) Ltd.

Tufnol, a fabric-reinforced material, was shown on the stand of Tufnol Ltd. A particularly interesting demonstration was a test jig, seen in Fig. 21, used for the measuring of stresses in rotor blades on helicopters for continued periods. Hordern-Richmond Ltd., showed examples of compressed and impregnated wood in the tool field, and examples can be seen in Fig. 22.

Jablo Propellors Ltd.

Jablo Propellors Ltd., have for many years specialized in laminated plastics for propellor blades and showed a variety of jigs and tools from these materials. The Airscrew Jicwood Co., Ltd., make tools, jigs, injection test fans and many other components from their laminated materials based on thermosetting resins.

Raw Materials

Wallington, Weston & Co., Ltd.

On the stand of Wallington, Weston and Co., Ltd., was an interesting working demonstration of the strength of the company's thermoplastic high impact material. The mouldings used in this test were telephone handsets and the

Fig. 25. (Left) Display of p.v.c. aircraft components manufactured by Hellermann Ltd.

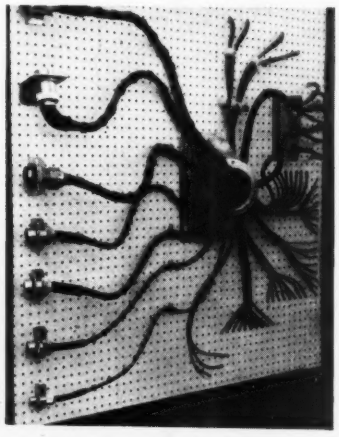


Fig. 26. (Right) Typical aircraft wiring assembly using Hellermann pressure bung.

Fig. 27. (Right) Aircraft fittings in Cobex, rigid p.v.c. manufactured by B.X. Plastics Ltd.

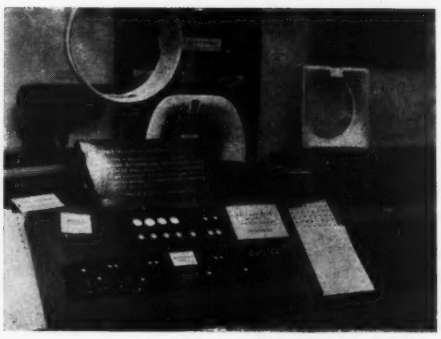


Fig. 28. (Left) P.v.c. protective covering for aircraft engine, by Export Packing Services Ltd.

unit can be seen in Fig. 23. The advantage of a thermoplastic material as a material for the aircraft industry lies in the fact that it is extremely tough, giving a very high impact strength material, being at the same time, rigid. Fromoplas is essentially a thermoplastic compound with a specific gravity of 1.24 and a tensile strength in the order of 10,000 lb. per sq. in. Impact strength, measured by B.S. 488/48, gives 14 to 16 ft.-lb. on a ½-in. sq. notched bar. For a moulded specimen the figure is 7 to 9 ft.-lb. Its superiority to the thermosetting materials is evidenced by its elongation at break, lying between 15% to 20%. The rigidity is unchanged up to 90-100° C., and the water absorption measured by B.S. 1137/49 is ¼%, 24 hours' immersion. It can be moulded, extruded, machined, formed and welded to itself and to metals.

British Oxygen Co. Ltd.

The British Oxygen Co. Ltd., showed examples of melamine cups and saucers and also electrical mouldings from moulding powders based on B.O.C. melamine. Apart from moulded applications, where it is particularly valuable from the point of view of its track and arcing resistance, melamine resins are important in the production of water-resistant adhesives, used in the construction of aircraft. Melamine based materials are also used in enamels and paints.

Bakelite Ltd.

Bakelite Ltd., as manufacturers of thermosetting materials, including phenolic moulding powders, and impregnating resins, are also concerned with the manufacture of polyester resins and p.v.c.

I.C.I. Ltd.

I.C.I. Ltd., are interested, through the Plastics Division, in the sale to the aircraft industry of a wide variety of plastics raw materials. One of the most important, which has special application in the cable industry, is polythene. Another, referred to on several occasions above, is Perspex. The I.C.I. stand was designed to show the service to the aircraft industry supplied by the Plastics Division, a service which reflects immense research work which has been carried out in this sphere of activity.

Cables and Other Electrical Applications

British Insulated Callender's Cables Ltd.

British Insulated Callender's Cables Ltd., make use of many plastics and synthetic rubber materials in cable manufacture. Polythene has very good electrical characteristics with negligible moisture absorption. P.v.c. is a good insulant and has wide use as a sheathing material, being tough, flexible and of attractive appearance. The ability to colour p.v.c. over a wide range facilitates its use in complex wiring systems. Silicone rubber and p.t.f.e. are also finding increasing use, with a considerably increasing range of surface temperatures. B.I.C.C. offer a very extensive service to the aircraft industry from the cable point of view. Some of the cables displayed at Farnborough are shown in Fig. 24.

Hellermann Ltd.

Hellermann Ltd., make use of thermoplastic materials, particularly p.v.c., in the manufacture of small components, bushes, grommets, etc., in a wide range of colours. These items, used widely in the aircraft industry, can be seen in Fig. 25. Fig. 26 illustrates a wiring system which makes use of the Helvin bung, moulded from p.v.c. of special formula, used in conjunction with a specially designed metal housing. The passing of electrical cables through pressure bulkheads has been considered as a major problem to the aircraft designer, restricted as he is to the limited space available and the need for keeping weight and equipment down to as low a figure as possible. As many as 150 cables can be passed through a bung measuring not more than 2¼ in. in diameter, and the effectiveness of the pressure seal is more than adequate for the stringent requirements of the modern aircraft.

Belling Lee Ltd.

On the stand of Belling Lee Ltd. were shown numerous moulded components for electrical applications, including connectors, plugs and sockets, terminals and fuse holders.

Interior Fittings

B.X. Plastics Ltd.

The stand of B.X. Plastics Ltd., was of considerable interest. One of the materials that is finding increasing application in the aircraft industry is Cobex, marketed by B.X. Plastics in sheet form, and eminently suitable for low-pressure moulding and vacuum forming. Cobex provides the rigidity that is normally lacking in thermoplastic materials and has been used to great advantage in window coamings, toilet seats and covers for winch parts, battery trays, etc. Fig. 27 shows most of these interesting applications, including in laminated form, instruction plates, fire control panels, and instrument panels. An interesting application in point has been the development for Vickers of a laminate for instrument panels where the wording is clearly readable by daylight and at the same time can be illuminated from the rear at night to give legibility with no glare; other applications of a more confidential nature are in train. Also made by B.X. Plastics is Saran yarn, used by Fothergill and Harvey Ltd., in the manufacture of Tygan material for upholstery.

Suntex Safety Glass Industries Ltd.

Suntex Ltd., also displayed a number of interior fittings for aircraft purposes including light covers.

Of the specimens shown, these included the Perspex nose fairing as fitted to the Percival Pembroke, incorporating fibreglass reinforcement. The company also showed various aircraft parts, including landing light covers, wing tip covers, amber Perspex panels for day/night flying training aircraft, Perspex tubing, laminated safety glass in several thicknesses, different hood panels as fitted to the Provost and Balliol aircraft, Perspex skins which form the complete fuselage for model aircraft, a variety of clear and tinted goggle glasses and instrument glasses, welding mirrors and curved laminated safety glass.

This company, together with its associates, Tyneside Safety Glass and Moon Aircraft Ltd., specializes in all types of safety glass and Perspex moulded window panels.

Packaging

Export Packing Services Ltd.

Export Packing Services Ltd., exhibited a very interesting container for an aircraft engine, designed for safe transport and permanent storage. The present American technique for the storing of aircraft engines may well cause corrosion and consequently damage, the actual protective envelope being virtually a tin can. Condensation within the can will, of course, cause corrosion to take place and Export Packing Services Ltd. have therefore developed their own protective envelope of p.v.c. As can be seen in Fig. 28 a tailor-made housing affords complete protection against corrosion, fitting the contour of the engine perfectly.

R. A. Brand Ltd.

R. A. Brand Ltd., demonstrated samples of thermoplastic protective films, applied in the liquid state, and subsequently forming a skin, as thick or as thin as may be required, which seems to be the answer to the protection of parts and tools for aircraft.

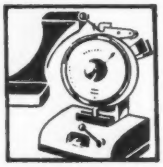
Finishes

John Hall and Sons Ltd; Cellon Ltd.

Synthetic materials are an extremely important constituent in many industrial finishes. The stands of John Hall and Sons Ltd., and Cellon Ltd., were designed to demonstrate to the visitor to Farnborough the important contribution of finishes to the modern aircraft industry. The variety of finishes called for in aircraft today is most extensive and the resins used range from cellulose acetate to alkyds and melamine.

World's Industry Employs Plastics

MATERIALS and TESTING



Radiation effects on long-chain polymers.—In certain polymers the transition from solid crystalline to amorphous structure can be investigated. Radiation gives a physical means of cross-linking and can be controlled without chemical agents or heat treatment. For other polymers controlled degradation can produce a known molecular weight distribution giving the opportunity for producing new plastics or modifying old treatment techniques. Bombardment with high-energy electrons has produced polyethylene bottles that can be sterilized.
(*Nucleonics*, 1954/June/18.)

Stiffness testing of elastomers at low-temperatures.—F. S. Conant gives some explanation for the demonstrated variations in Young's modulus at low temperatures reported by different laboratories, based on the nature of the different tests and test procedures.
(*ASTM Bulletin*, 1954/July/67.)

Plastic references for the mechanical engineer.—P.O. Powers and coll. give a survey of recent publications of interest to the mechanical engineer dealing with materials (31), properties of plastics (47), fabrications (55), application (44), laminates and reinforced materials (25) and coating (16). Reference numbers are given in brackets.
(*Mechanical Engineering*, 1954/Aug./663.)

Plastics—Types.—A German standard has been prepared being a survey of the various plastics at present on the market. The purpose is to bring a certain order to the industry and to introduce hallmarks. The word "Kunststoffe" is being replaced by "Plaste."
(*DIN Mitteilungen*, 1954/July/310.)

ASTM Annual Meeting.—The following papers on plastics were presented: Measuring viscosity of thermosetting resins by parallel plate plastometry by D. I. Marshall; Effect of crystallinity and crazing, ageing and residual stress on creep of Kel-F, Canvas laminate and geon respectively by W. N. Findley; Creep-time relations for nylon in tension, compression, bending and torsion by J. Marin and coll.; Time-temperature relationship for rupture stresses in reinforced plastics by S. Goldfein.
(*ASTM Bulletin*, 1954/July/28.)

Hardness testing of elastomers.—B. G. Labbe compares the performance of seven different commercial rubber testers with regard to efficiency and reproducibility of results at low temperatures.
(*ASTM Bulletin*, 1954/July/73.)

Insert nuts for thermosetting moulding parts.—German draft standards for through-going nuts and closed nuts of different types have been published.
(*DIN-Mitteilungen*, 1954/July/304.)

Hardness testing of soft material and lacquers.—P. Grodzinski describes the TNO hardness testing method and his own instrument which will distinguish between plastic and elastic hardness. The latter instrument also indicates creep and relaxation in a load (time), depth of indentation, diagram.
(*Industrie Kurier* (*Technike Forschung*), 1954/July 21/231.)

Plastics, new papers.—Papers read at a symposium of Plastic Institute of Technische Hochschule Aachen include the economic importance of plastics (Prof. K. Krekeler); Fully synthetic thermoplastics (W. Klein); Limits of application of plastics (H. Saechtling); New production methods for thermoplastics (H. R. Jacobi); Thermo-setting plastics, production and application (H. Meis).
(*Industrie Anzeiger*, 1954/July 13/875 and July 20/907.)

PROCESSES : MACHINERY

Swiss machines for the plastics industry.—A general survey of Swiss machines, including mixing and kneading machines, presses and extrusion machines.
(*Techn. Rundschau* (Berne), 1954/August 27/9.)

Injection moulded nylon gears.—L. D. Martin recommends the use of nylon gears ranging from lightly loaded clock parts to highly stressed washing machine gears.
(*Tool Engineer*, 1954/July/61.)

Polishing plastics.—Practical workshop recommendation with regard to abrasives, lubricants and tools are given by P. W. Blandford.
(*Mechanics*, 1954/July 16/234.)

INDUSTRIAL APPLICATIONS

Moulding glass-fibre parts with press dies.—R. McIntosh describes the use of steam-heated die sets with conventional metal presses. This brings speed, simplicity and precision of detail to the moulding of glass fibre aeroplane parts.
(*Machinery* (*New York*), 1954/July/219.)

Plastic body.—The Chevrolet Corvette plastic body is now produced by the so-called matched metal die process, after having been made experimentally by hand methods.
(*Automotive Industries*, 1954/Aug. 15/66.)

Plastic rings as shaft retainers.—The new Plasti-Rings are rolled into prepared grooves and serve as a positive holding shoulder highly resistant to abrasion and wear. They will withstand up to 250 lb. in direct shear. The ring is injection moulded in vinyl.
(*Tool and Die Journal*, 1954/August/69.)

Protective coating for spray booth.—A strippable plastic film coat "Peel Filmite" which gives protection against fire and is resistant to greases and solvents. It dries to a uniform white opaque coating in about 10 minutes.
(*Machinery* (*New York*), 1954/Aug./184.)

Plastic impregnated laminated mahogany is being used experimentally by the Ford Motor Co. for wood die models, ordinary patterns and patterns for experimental runs of shell moulded parts.
(*Automotive Industries*, 1954/July 15/50.)

Plastic pipes in mining.—A number of gold and coal mines in South Africa have started to introduce polythene piping in both underground and surface workings.
(*South African Mining and Engineering Journal*, 1954/July 10/735.)

Laminated Tooling with Epoxy resins.—Low shrinkage and good adhesion of these resins are solving many problems in the production and use of plastic tools in metal working industries.
(*Materials and Methods*, 1954/Aug./93.)

Safety windows for grinding machines.—A cast-allyl base plastic having high impact strength and resistance to abrasion by flying metal particles.
(*Machinery* (*New York*), 1954/August/184.)

Plastics for tooling.—N. M. Hastings gives useful data on mechanical and physical properties of plastics useful for tooling, e.g., cast-resins, laminated materials and hot melt materials.
(*Tool Engineer*, 1954/July/142.)

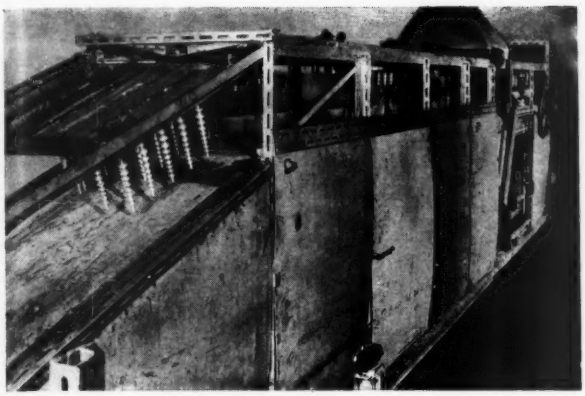
Nylon belts for drop stamps.—These are now replacing hair belts. They have a high operating efficiency at reduced costs. A belt in a 4-cwt. stamp was still in use after four years having lifted 2,800,000 tons.
(*Machinery* (*London*), 1954/August 20/376.)

Neoprene cover for belt pulleys.—A neoprene sheet material "Neolog" can be applied to pulleys by a cold bonding agent and increases considerably the coefficient of friction.
(*Machinery* (*New York*), 1954/August/184.)

MISCELLANEOUS USES

Elastoplastic closures have been produced to protect valuable parts against shipping and handling damage. Easy to put on and easy to take off, they hold securely during transit and storage. Tubular parts are effectively sealed against leakage and exposed threads protected. Produced by S. S. White, Plastics Division, New York 16.
(*Instrument Manufacturing*, 1954/July-August/153.)

Thermoplastics and their treatment.—H. Peukert discusses the structure and proportion of thermoplastics, followed by a survey of investigations on processes in the thermoelastic and thermoplastic ranges. In particular the welding range of PVC foils in relation to pressure, welding time and foil thickness, has been investigated.
(*Industrie-Anzeiger*, 1954/Aug. 13/993.)



Dip Moulding and Coating with Plastics

Durable Plastics Ltd., of Guildford, have for some time specialized in dip moulding metal units in plastics. The company has now initiated a dip coating service to industry, and the process and some applications are described in the following article.

Fig. 1—Mechanized dip moulding.

DIPPING as a technique is one of the oldest and most well established in the manufacturing field, and the advent of plastics materials not unnaturally turned the attention of manufacturers to the possibilities offered by synthetics generally. It was not until the advent of p.v.c. however that emulsions and dispersions became accepted as a suitable basis for this kind of work. The field may be roughly divided into two parts, the first, covering dip moulding, which has its roots in the rubber industry, and the second, dip coating, a somewhat newer technique but rapidly coming to the forefront.

Dip moulding has now reached a considerable level of skill, and much ingenuity has been put into the design of semi-automatic machines capable of mass-producing dip moulded articles at relatively high production speeds. Durable Plastics Ltd., of Friary Square, Guildford, have installed a highly efficient machine of their own construction, a general view of which is shown in Fig. 1. In this can be seen the endless moving chain belt on to which carrier racks are fitted. From these carrier racks are suspended formers, inexpensively turned from soft metals, which move slowly through a heating unit, after which they are dipped into p.v.c. solution. Depending upon the solution viscosity, the size and thermal capacity of the formers, and upon the time in which the formers are allowed to remain in the bath, is the thickness of the coating applied. After leaving the bath, the formers are passed into a curing oven, and finally water quenched. This last-mentioned process ensures that the mouldings have been cooled to below deformation point and also provides a fine surface finish. The mouldings are then pulled away from the formers. The production rate in terms of weight of material is extremely high and typical examples of applications are dust covers, connectors, vacuum cleaner buffers and many items for the Ministry of Supply. Examples can be seen in Fig. 2. Durable Plastics have initiated considerable experimental work in this field and foresee a substantial future for dip-moulded products.

There are, of course, certain drawbacks to the technique, principally the difficulty of maintaining close tolerances on the wall thickness of dipped articles. If the tolerance is less than plus or minus 5% dip moulding is not a suitable process for the production of the articles. It is, of course, only possible at the moment to produce flexible articles, another limitation in so far as applications are concerned. On the other hand, however, there is the advantage of low tool cost, the production of flash-free mouldings, and the ability to change tools at will. This latter gives the dip moulder an enviable advantage over the injection moulder. Additionally, there is the question of production capacity. A typical rack will hold as many as 50 formers, each picking up some 5 oz. of material. The production cycle would be in the order of one rack dipped for every three minutes, giving a net shot per rack of 10 lb. of material, a figure roughly double that of the biggest injection moulding machine yet available in this country.

Dip Coating

In the dip coating field, the company has embraced both p.v.c. and polythene as coating agents. In the case of the former, baths of p.v.c. in dispersion form are employed. In the latter case, the coating agent is in finely divided powder form.

Fig. 3 shows the commencement of a typical wire dipping production line for awkwardly shaped articles, when automatic plant will not suffice. Wire articles, having previously been heated in an oven are suspended by very thin wire and dipped into the polymer dispersion. The contact of the heated material with the dispersion causes a certain quantity to gel

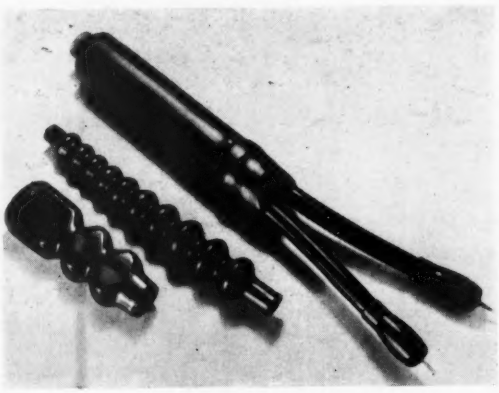


Fig. 2 (Left)— Examples of dip moulded articles, including a cable-connecting device and a flexible coupling.

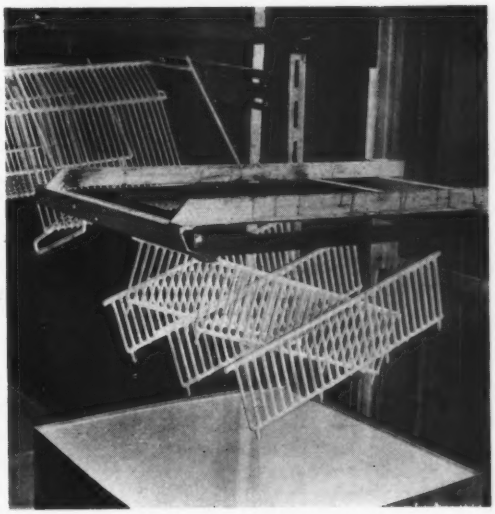


Fig. 3 (Right)— Commencement of a wire dipping line.

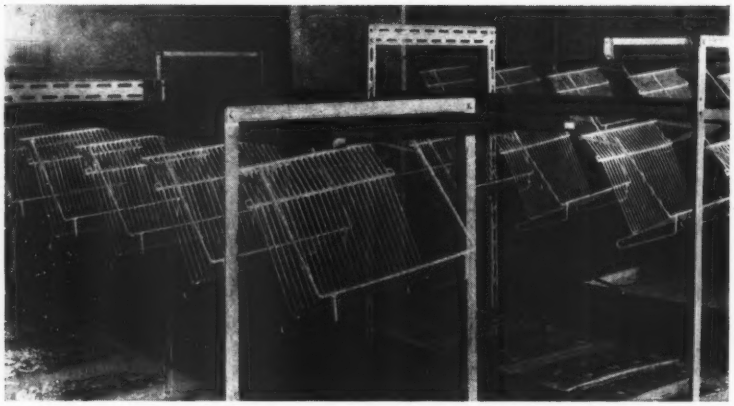


Fig. 4. (Left) Dipped articles move along conveyor racks.

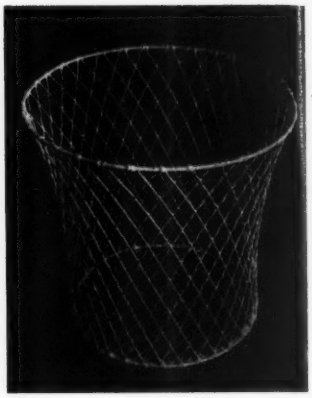


Fig. 5. (Right) Waste paper basket coated in p.v.c.

immediately over the component's surface. The actual quantity of material taken up by the component will depend upon the gauge of wire being used, the length of time the component is left in the oven, and to a lesser extent upon the duration of immersion of the component in the polymer bath.

After suitable dipping time, the component is then lifted clear and allowed to drip, first of all for a few minutes into a main bath, and then into secondary baths. The residual drips, which may have partially gelled, can be removed electrostatically or by hand. The angle at which components are suspended is, of course, important since it is essential that no unsightly bulges of material should be obtained at any one point. It is also important to avoid, if possible, the use of wire, in the make-up of the component, of greatly differing gauge. The variation of material taken up caused by the difference in thermal capacity may give unsuitable results.

As can be seen in Fig. 4, the components move on rollers along a series of racks during which they are allowed to drip, the residual polymer being used again. The final stage is the curing of the components in an oven, which not only hardens off the resin coating, but also imparts a gloss to the surface and brings the plasticizer content down to a predetermined level. A typical example of this type of production is the waste-paper basket seen in Fig. 5 which has been rendered decorative in appearance and permanently rust-proof.

In the case of polythene, the pre-heating treatment of the article to be coated is similar to that of p.v.c. The temperature varies depending upon the gauge of the wire component; for thin wire components the oven would be maintained at 190° C., whereas for thick wire, or a solid object such as a control wheel, the oven temperature would be 140° C.

The next stage is the agitation of the component in the polythene powder, either sprayed or mechanically. The heat contained within the component causes the coating of polythene to gel over the surface. For certain articles Durable Plastics have devised automatic plant which greatly increases production capacity, and this is being extended to cover all phases of their work.

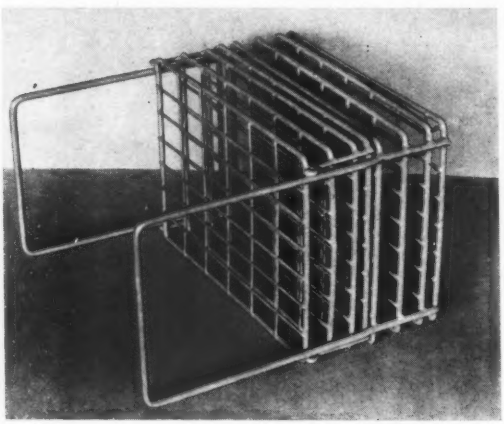
Having achieved the necessary covering, the components are then placed in an infra-red oven at approximately 140° C., where they are sintered, emerging with an excellent finish. The duration of the sintering process depends again on the gauge of wire used, ranging from 1 to 10 minutes. Polythene is at the moment the preferred material for coating in that the finish is generally more durable and there is also, of course, the absence of drips which makes for more speedy production, although p.t.f.e. will shortly be offered as a commercial coating. A typical polythene-coated component is shown in Fig. 6. More solid objects including knobs and clips are shown in Fig. 7 and in Fig. 8 is shown a meter case.

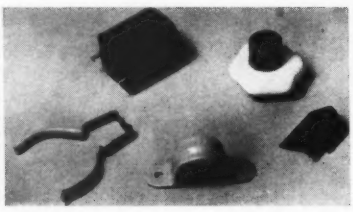
Fig. 9 shows a control wheel, designed for use on cigarette-making plant, which has been dip coated with polythene. An important advantage in this particular application lies in the fact that the castings for these control wheels do not require a high degree of finish before being coated. Any roughness in the surface is filled in by the material.

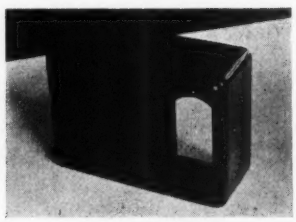
In general terms, it is important that the wire work itself is completely grease-free before dipping, and is also free from sharp protruding edges or points.

The general considerations that govern the economics of dip coating are the basic handling cost, the quantity of polymer consumed in any specific application, and the general shape of the component.

As a trade service to industry, this process obviously has a great deal to offer and we may expect to see even greater mechanization in the future.







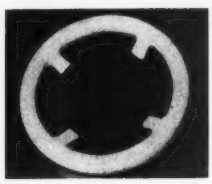


Fig. 6. (Left) Photographic accessory which has been dip coated with polythene. Fig. 7. (Above) Knobs and clips dip coated in polythene, some of them by the automatic process. Fig. 8. (Above, right) Meter case coated in polythene. Fig. 9. (Right) Control wheel coated in polythene.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Venetian Blind Slats

SIR,—We are interested in obtaining plastic slats, for venetian blinds and would be grateful for names and addresses of manufacturers of suitable slats.

HAINES AND SON.
122-124 High Street,
Staines.

Plastic or Plastic-lined Drums

SIR,—We are interested in obtaining a number of 40-45-gallon plastic drums suitable for packing Butteroil liquid for the Swedish market thence for re-export to the Far East.

A. JOHNSON AND CO. (LONDON), LTD.
Africa House,
Kingsway,
London, W.C.2.

[EDITOR'S NOTE: Plastic drums are clearly not yet available for foodstuffs. The polythene lined drum, as a weldable bag within the drum has been on the market for some years. Weldable polythene bags are produced by E. S. and A. Robinson, Ltd., of Bristol and Paper Goods Manufacturing Co., Ltd., Sutton, Surrey. Presumably the welding of the bags is carried out by the user.]

Plastics Candlesticks

SIR,—We have recently seen attractive pigeon-shaped candlesticks, samples of which we enclose. These, we believe, are made in polystyrene and we are wondering whether you could put us in touch with the manufacturers, who are unknown to us.

FABRICA MATERIAL LINEAR.
Rua da Vitoria 153,
Porto,
Portugal.

Plastic Letters

SIR,—We are looking for the manufacturer of plastic letters who sells his products in boxes marked with "A Merit Toy." On the boxes there is a name J. and L. Randall, Ltd. We are very anxious to get into contact with the manufacturer of these letters, so we hope you are able to supply us with the address.

FA. J. G. VAN BOVEN.
P.O.B. 10,
Gorinchem,
Holland.

Method of Cable Stripping

SIR,—We are requiring a method of stripping the p.v.c. from electrical cable, the p.v.c. being of varied diameters—the total amount being approx. 50 tons. Do you know of a satisfactory method?

INVICTA PLASTICS, LTD.
137 Queens Road,
Leicester.

Trade Name

SIR,—Could you give me the address of Messrs. H.P. Products, makers of Perspex trays and covers for the catering trade.

A.R.

Thermoset Extrusions

SIR,—We would be very much obliged if you could give us names and addresses of English manufacturers of extrusion presses for thermosetting moulding material like Bakelite. So far as we know, such machines were first introduced about 17 or 18 years ago and came from Germany. It is possible that such machines are not made in this country, and if this is the case you might perhaps have the name and address of the German firm on your files.

S.R. (PLASTICS), LTD.
93 Aldersgate Street,
London, E.C.1.

Liquid Plastic Material

SIR,—We shall be much obliged if you will let us know the name and suppliers of the liquid plastic material referred to in the "Surgery and Burglary" note in Moulding Powder and Shot which appeared on page 282 of the September issue of *Plastics*.

ROYAL NATIONAL INSTITUTE FOR THE BLIND.
224 Great Portland Street,
London, W.1.

Plastic Ink Well

SIR,—We are seeking the makers of an ink well or ink holder; the product we have in mind is roughly 2 in. in length, and we imagine it is moulded in a thermosetting material. The holder is mounted on a universal joint. This type of holder was displayed in the second part of the Advertising feature of "Plastics in the Service of Man" which appeared in *Plastics*, October, 1953.

MESSRS. GLENWOOD PRODUCTS.
Fir Tree Works,
Woburn Sands,
Bletchley, Bucks.

Plastic Handles for Tools

SIR,—I am looking for a suitable plastic with which to make a 4-in. by 1-in. approximate round handle for a tool, the main function of which (i.e., the handle part) would be as an ornamental grip. That is, the handle would take little or no stress. It would be attached to the body of the tool by way of a 2-in. metal tang; this latter would take all the load.

W. ROPER-LINDSAY.
34 Moorcroft Road,
Birmingham, 13.

Heat-sealing Equipment

SIR,—We propose to investigate the possibility of replacing the present method of sewing jute sacks by an automatic heat-sealing operation, using, of course, the type of plastics normally employed for this type of work.

We should, of course, be particularly interested in the probable rate of production of such machines when employed for the sealing of jute bags, and the approximate cost of these. To this end, we are anxious to make contact with the makers of suitable equipment.

INDIAN JUTE MILLS ASSOCIATION.
Baltic House,
27 Leadenhall Street,
London, E.C.3.

Plastic Netting for Luggage Racks

SIR,—It has come to our attention that on the Viscount aircraft of B.E.A. the net luggage racks are of plastic netting and we would be grateful for any information regarding manufacturers of this netting.

SIMPSON-LAWRENCE, LTD.
St. Andrew's Square,
Glasgow, C.1.

Bonding Metal to Plastics

SIR,—We are wondering if you know of any type of glue which is colourless and will fasten metal objects securely and cleanly to transparent plastics material.

GEORGE SALTER AND CO., LTD.
West Bromwich,
Staffs.

Foamed Polyurethane

SIR,—Can you put us in touch with manufacturers of a polyurethane suitable for foaming?

E. ILLINGWORTH AND CO. (BRADFORD) LTD.
Shelf Mills, Halifax,
Yorkshire.

Chemical Plant Equipment

SIR,—We shall be pleased if you will furnish us with names and addresses of any manufacturers of plastics acid-handling equipment, pumps, etc.

CRITCHLEY BROTHERS LTD.
Brimscombe,
Stroud,
Gloucester.

Plastic Plugs

SIR,—We should be obliged for any information as to where we could obtain a quantity of 14-mm. plastics plugs. These are required for the purpose of fitting to the spark-plug hole of reconditioned engines, to stop the ingress of dirt, etc.

HAMILTON MOTORS (LONDON) LTD.
466 Edgware Road,
London, W.2.

The Food Fair

An increased use of plastics in the packaging of food as indicated by the Food Fair, opens an increasing market to manufacturers and gives wide scope for further development in this important field.

THE sales appeal of food packed in transparent closures, the growing use of plastics for hygienic wraps, and the use of plastics in wrapping pre-cooked foods; these were the three important trends for the plastics industry which emerged from the recent, and highly popular, Food Fair in London.

Promoted by the Food Manufacturing Federation Incorporated and sponsored by the *Daily Express*, this year's Fair, the first since the end of rationing, is perhaps the most truly international yet held. Fifteen countries were represented and a wide variety of imported and home produced goods were on show.

It was obvious that both manufacturers and distributors were becoming display conscious and the improvement, both in design and originality of their packages, was to be seen in all parts of the exhibition. The general public, it was evident, was appreciative of this trend and such encouragement should act as a stimulus for further development along these lines.

Greater importance is now being attached to food hygiene both in the factory and in the house. This interest, awakened and activated by the local councils and Government's "Cleaner Food" campaign, has opened up a new field for the use of plastics, particularly polythene and cellulose acetate film. Already, considerable use was being made of these materials on goods which previously had been sold unwrapped. This is a step in the right direction and should lead to general adoption.

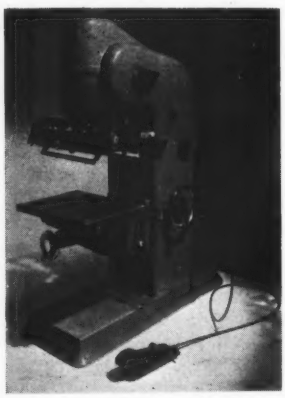
Packaging

The Metal Box Company devoted a large portion of their stand to the display of Diothene bags. The colour transparencies showing foods packed in them, attracted considerable interest and showed to great advantage the usefulness of this product. The bags were on sale to the public and it seemed from the business transacted that already considerable use has been found for them in the home.

Cauliflower packed in Clarifoil.

Another form of packaging which has received wide popularity is the cardboard box with a transparent window. British Celanese, Ltd., one of the principal suppliers of cellulose acetate film, had on show a range of boxes using their film. With this display was a Lerner rotary patch lining machine demonstrating the actual sticking of film to window cartons on a completely automatic basis. One of the principal disadvantages in the use of Clarifoil has been its tendency to mist when used on its own for packing. British Celanese have overcome this in their new product Cellastine which was on show for the first time. Similar in appearance to Clarifoil it does, however, permit the contents to "breathe" and in consequence does not become misty. Various acetate-wrapped foods were displayed in a refrigeration unit to demonstrate this quality. These products were supplied by the Pre-packaging Development Association, whose aim is to find out which foods and produce are most suitable to packaging and which materials are the best for the job. In furtherance of this aim they have been marketing tomatoes prepacked in Cellophane bags to assess the reaction of the general public to this idea.

As a general principle a housewife will buy a commodity for one of two reasons, either because it looks attractive or because



Masseeley Model 41 Automatic Printing Machine.

she knows the manufacturer or distributor will provide the quality she demands. Traders, therefore, require their containers to be printed. Specialists in this field are Masson Seeley who on their stand were demonstrating the Masseeley process for printing polythene, p.v.c. and cellulose acetate. By using dry pigmented foil with a finely controlled heat and pressure, a very clean print is obtained. The adhesion of the print to the material is of a particularly high standard and should provide the answer to many printing queries. Their machines which have been designed for all requirements of production and materials are especially suited to the printing of polythene bags and acetate price tickets. Fully automatic or foot-operated with varying speeds, they are easy to set up, and produce a fine job of work. The foil is supplied by Masson Seeley in a very wide range of colours.

Although the majority of the Fair was devoted to food in all its various aspects and forms, there were several exhibitors whose products were so closely connected to the kitchen and the preparation of food, that to have missed them out would have destroyed the completeness of the exhibition. Here again, plastic materials were making headway and on the stands of William Levene, Ltd., and their associates W. J. Rite, Ltd., could be seen kitchen gadgets of many and varied designs. Photographs of some of these appeared in our August issue in "Plastics in the service of man." Another exhibitor, Bearston Metal and Plastic Co., was also showing a wide range of plastic kitchen-ware.

Cakes and other foodstuffs which attract flies, and also depend on their appearance to a large extent for sales appeal, can now be protected by transparent Perspex covers and displayed on Perspex trays. Digby and Nelson, Ltd., are the distributors of these items together with their efficient Handee cheese cutter, which has a white urea base making it attractive to look at and hygienic to use.

New Hygiene, Ltd., and Furmoto Chemical Company, used polythene bottles for their products. The former used them as containers for their deodorant, disinfectant and insecticide and the latter for their "Spectacleer" lens polish. The advantage of these bottles for producing a mist or spray was fully demonstrated.

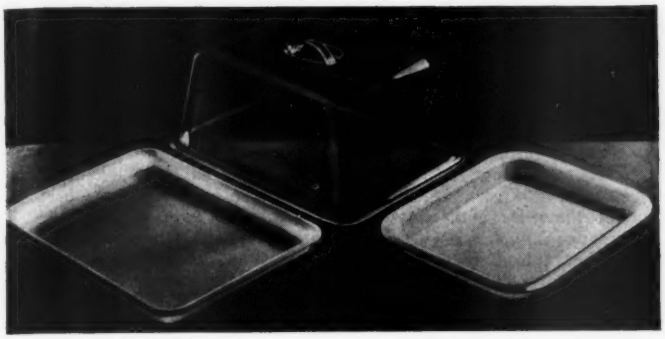
Terylene and Nylon overalls are becoming more popular, and nowadays the overall can be an attractive housecoat without losing sight of its original purpose. This was fully demonstrated in the display of these garments by Whaley Bridge Manufacturing Company.

Decorative Laminates

Thomas De La Rue and Co., Ltd., had a comprehensive display of Formica laminates which showed their non-absorbent properties and wide range of surface designs and colours. This material, so ideally suited for table tops which will be subjected to staining or scorching, is finding an ever-increasing market in snack-bars, canteens and in the kitchen. Besides its hard surface, chemical inertness and non-absorbent properties which make it so important in the interests of food hygiene, the wide range of colours available enable the shopfitter or housewife to maintain their colour schemes.

Laminated p.v.c. gloves with high-frequency welded seams, designed for the protection of the home handyman or woman, were on show on the stand of Plysu Sales. Ltd. In addition, they displayed the popular Supermaid wet sponge mop. This novel mop has an injection-moulded polystyrene sponge holder and cellulose sponge, making it light and easy to use.

New Productions



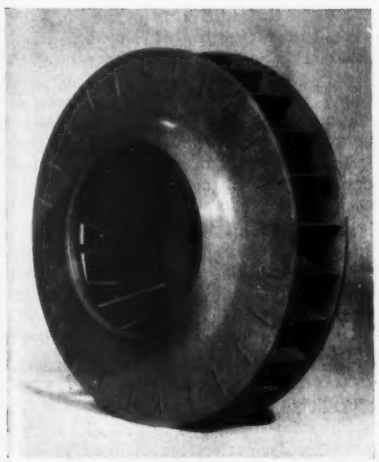
(Left) Food covers in Perspex developed by Plastics (Manchester) Ltd.

Hygienic Food Covers

A novel and hygienic food cover has been developed by Plastics (Manchester), Ltd. This company has been moulding Perspex trays as a standard line for the past nine years, and three years ago, in the face of increasing insistence upon hygiene in all places where food is sold, displayed or handled, they designed and tooled up for the production of a clear Perspex cover to complement the trays which are available in a range of approximately thirty colours. The covers have been specially designed with moulded lips which match and fit over the outside edge of the tray, which has an identical moulded lip to accommodate the cover. In effect this provides a completely dust- and dirt-proof cover, offering an unobstructed view of the contents, while simultaneously protecting them. In addition, allowance has been made at the four corners of the cover for the free passage of air from underneath to prevent mustiness or contamination of the goods displayed. An assortment of sizes is available, ranging from 12 in. by 10 in. to 18 in. by 13 in. on the standard range and large sizes can be moulded to customers' specification.

Plastics Fan

Cobex is the registered trade-mark of the rigid vinyl material made by B.X. Plastics Ltd. The first of these rigid vinyls to be made on a commercial basis, it is now widely employed in many fields of plastics fabrication. Amongst its advantages are high dimensional stability, non-inflammability, wide range of colours, including clear transparent and transparent colours, and ease of manipulation of simple, sheet-forming plant. It also possesses high resistance to most chemicals at temperatures up to approximately 60° C. The illustration shows a fan fabricated from Cobex, on the built-up principle, consisting of two circular flanges into which the fan blades have been slotted. This fan was made by the Hockley Chemical Co., Ltd.



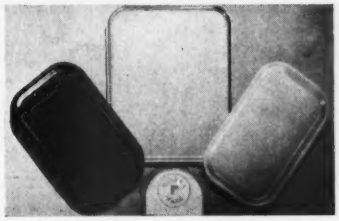
Fan in Cobex.

Decorative Trays

Helenaware, Ltd., 3 Vere Street, London, W.1, have opened a new range of laminated trays especially suitable for hospitals, canteens, schools and in the home. Under the trade-mark, Runcolite, these trays are now being sold; among the advantages claimed for them are great strength, resistance to staining and heat, light weight and silence in use. Both hammer and glossy finishes are available.

Dunlop Puffer Pack

Illustrated is a small container which is being made by Universal Metal Products, Ltd., in polythene for the Dunlop Rubber Co., Ltd., for inclusion in their cycle repair outfits. This flexible container is in two parts, base and push-in cap, the cap having a hole in the top into which a pin is inserted when the pack is not in use. The pack is designed to hold dusting chalk which is sprayed from the container over the repaired part of the tyre. It takes the place of the old chalk block which used to be grated onto the repair, and is, of course, much more convenient in use. The container is printed, after moulding, in a contrasting colour.



Decorative Laminated Trays.

Dunlop Puffer Pack.

New Labelling System for Polythene Bottles

One method of solving the problem of polythene bottle labelling is the subject of patents held by Mr. Niels Johannsen, 11 Frederiksgade, Copenhagen. Our photograph shows a typical example. The system employed is to turn two parallel recesses in a normal bottle mould. The resulting ridges in the moulded bottle, as seen in the photograph, hold in place a thin cylinder of polythene which can thus be turned freely around the bottle. A slit in the cylinder enables a label to be pushed underneath it; turning the cylinder leaves the label in position and protected against possible damage. The label can be easily changed. Even mishandling of the bottle will not affect the label at all and full protection is provided against dirt and chemical attack. The cost of incorporating this system of labelling is estimated to be in the region of ½d. per bottle.

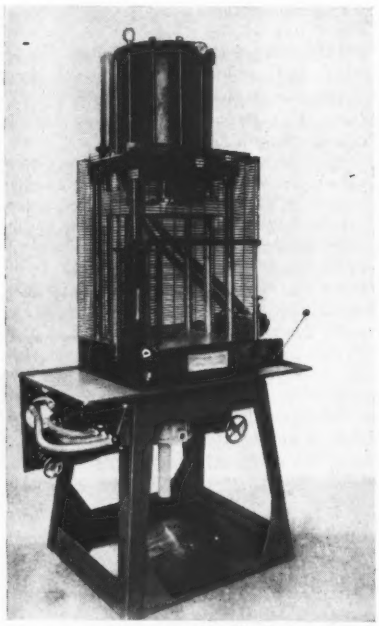
Labelling Polythene Bottles.

Plastics NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

A NEW FAST-MOULDING PRESS FOR ALKYDS.—The new alkyd moulding materials which are now coming into general production require much faster presses than are normally available for thermosetting materials if full advantage is to be taken of their advanced characteristics. In addition to excellent electric- and arc-resisting properties, these materials will cure in 10 to 12 seconds for a moulding ⅛ in. thick. In addition, moulding pressures are claimed to be lower, between 800 and 1,200 lb. per sq. in., as against 2,000 to 4,000 lb. per sq. in., normally called for with phenolic materials.

E.M.B. Co., Ltd., of West Bromwich, Staffs, have devised an air-operated press which offers more speedy cycles, on lower pressures and which is, therefore, claimed to be admirably suited to the moulding of these



New press for alkyds.

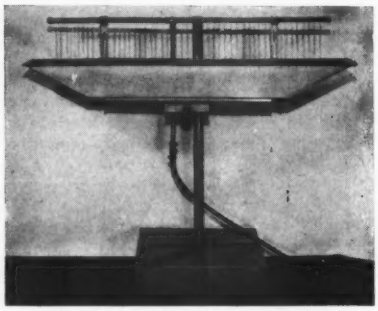
alkyd materials. Using compressed air from any standard line of 80 to 100 lb. per sq. in., the main air cylinder will exert a force of 9 tons through a stroke of 12 in. The top platen, carried from the cylinder ram, is located by two heavy-section vertical guide bars to ensure accurate alignment. This cylinder is carried on four tie bars and can be adjusted vertically to give a daylight of from 12 in. to 24 in. A separate air cylinder is mounted underneath the table and exerts a force of two tons through 4 in. stroke for ejection of the work when required, this stroke being adjustable to suit the die being used. The up-and-down motion of the main platen is controlled by the handle at the right-hand side of the press. The handle for controlling the ejection ram is located at the left of the table. The pressures (moulding, return and ejection) are variable, by means of the pressure regulators provided. The operator is completely protected by a mechanically interlocked guard which prevents operation of the press until the guard is closed. The press is typical of the machines which can be rapidly built up from the standard components of the E.M.B. unit air equipment.

FINNEY PRESSES, LTD., announce that they have been appointed sole selling agents for the range of injection moulding machines manufactured by Albert Stubbe, G.m.b.H., Vlotho/Weser, Kalldorf, Germany. These machines are available in sizes 2 to 10 oz., and for use with oil or water, with or without pumping equipment.

NEW-DESIGN FRACTIONAL H.P. ELECTRIC MOTORS.—General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, announce a new range of fractional h.p. A.C. motors. More compact and of less weight, they have been designed to comply with B.S. 2048 and are mechanically interchangeable with other makes complying with this specification. Apart from the flange-mounted motor, they are also interchangeable with American motors made to the N.E.M.A. standard. Full details and specifications can be obtained from the manufacturers.

INCREASED RANGE OF PLATING BARRELS.—In view of the popularity of the Typhon Barrel, W. Canning and Co., Ltd., of Birmingham, have adapted the design to cover a range of these barrels ranging in size from one pint to two/three-gallon capacity.

NEW HIGH-SPEED INJECTION-MOULDING MACHINE.—A new horizontal injection-moulding machine which is claimed will feed up to a 4 oz. shot and function automatically at a speed of 780 cycles per hour is now on the market in America. The machine is manufactured by Moslo Machinery Company of Cleveland, Ohio.



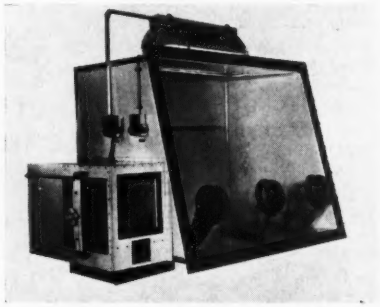
Maniplastics extrusion equipment.

WATER BATH EQUIPMENT FOR EXTRUSION.—Maniplastics Ltd., manufacturers of the Manistruder extrusion machine have recently added to the list of ancillary equipment available: water bath take-off equipment.

INCREASED PRESS CAPACITY.—E. K. Cole, Ltd., have extended their injection moulding press capacity with the installation of another 48 oz. machine.

FRANCIS SHAW AND CO., LTD.—We regret that on page 276 of the August issue of *Plastics* this company was inadvertently referred to as Francis Shaw and Son.

NEW LABORATORY EQUIPMENT.—Manufactured by Mallinson Brothers, Ltd., Brown Street, Salford, 3, Lancs, the glove cabinet shown in the illustration is used in the preparation and handling of certain radio-isotopes and for work with highly toxic materials. It is constructed from Plimberite chipboard, veneered with ivory Ultrapas melamine laminated plastic sheet. The sheets are bonded with Aerolite adhesive. The corners are sealed with a compound based on the Araldite range of ethoxylene resins, and the front window, fitting in a special gas-tight seal, is of Perspex, to which



Equipment for dangerous chemicals.

are fitted special ports with rubber gauntlet gloves.

The operator works with his hands through the rubber gloves, the pressure inside the cabinet being kept appreciably lower than the atmospheric pressure by means of a suction pump. In this way there is no danger of radio active particles being inhaled by the operator. The cabinets are being marketed in conjunction with Townson and Mercer, Ltd., of Croydon.

NEW EPOXIDE RESIN.—Leicester, Lovell and Co., Ltd., announce an addition to the present range of Epoxide resins. Known as Epophen M-777 the advantages claimed are absence of exotherm in large masses, greater strength, and lower cost. To facilitate small-scale industrial testing of this resin, test kits have been prepared, price 7s. 6d., which will be supplied on application to the manufacturers at North Baddesley, Southampton.

PRINTING OF POLYTHENE.—The treatment of polythene by the Kreidl Process for durable printing has been demonstrated by the Frank W. Egan Company of New Jersey, U.S.A. Present machinery operates at 325 ft. per minute but higher and lower speeds can be attained.

AMERICAN PLASTIC WELDING EQUIPMENT.—Automatic welding machines developed by Plant Plastics Inc., of Knoxville, Tennessee, are claimed to weld both rigid and flexible plastic material at a rate of up to 300 ft. per hour.

NEW PLANT FOR THE PRODUCTION OF ETHYLENE DIAMINE.—Fisons Ltd. plan to construct plant for the manufacture of ethylene diamine and its homologues capable of fulfilling the requirements of this country. First supplies are expected next year and will be distributed through Whiffen and Sons, Ltd., North West House, Marylebone Road, London, N.W.1.

INCREASED PRODUCTION OF SULPHURIC ACID.—A new plant capable of producing 33,000 tons of sulphuric acid per year has commenced operation at the Stanlow (Cheshire) Oil Refinery of the Shell Petroleum Co., Ltd.

POLYTHENE PRICE REDUCTION.—I.C.I., Ltd., recently announced a reduction in the price of polythene to 3s. 2d. per lb.

COOLING OF P.V.C. COMPOUND POWDER MIXES.—To avoid caking of the powder when it is packed immediately after mixing, British Geon, Ltd., advocate the use of a cyclone cooler in conjunction with a coarse sieve. Cooling from 100°-120° C. to 40°-60° C. at 1,800 lb. per hour is claimed to be possible.

HIGH-TENSILE NYLON SUPPLIES.—John Tullis and Son, Ltd., announce that Tullon is now available as profiled shapes, discs, strips and pressings up to a thickness of 1/10 in. in single ply. Width is limited to 8 in. for this thickness but can be increased for reduced thicknesses. Multiple laminated sections can also be supplied. Further details and specifications can be obtained from the manufacturers at St. Ann's Works, Glasgow.

POLYVINYL ALCOHOL FILM.—Manufactured under the trade name of Pevalon H 11, this film it is claimed, is soluble in water at temperatures above 65° C. and remains in solution on cooling. At lower temperatures it softens and dilates but does not readily dissolve. Its counterpart Pevalon H 12 dissolves in hot or cold water. Both films are claimed to be unaffected by most organic solvents, petroleum, greases and animal and vegetable fats. Supplies of these films and any technical details required can be obtained from the distributors M. and B. Plastics, Ltd., 45-47 Wigmore Street, London, W.1.

POLYTHENE TUBES.—Erinoid, Ltd., of Stroud, are now manufacturing polythene tubing. Bore sizes are from $\frac{3}{8}$ in. to 6 in.

EDWARD DAVIS (PLASTICS), LTD., is the new name of Davis Bros. (Metal and Plastics), Ltd. As recorded in the last issue, new warehouses have been established at 7a West End Lane, London, N.W.6, and 83a Cable Street, London, E.1. The head office of the company is at 20 All Saints Road, London, W.11.

TERYLENE COUNCIL of Imperial Chemical Industries, Ltd., is moving to Harrogate from their present address at Welwyn, Herts. The move is expected to be completed, with the exception of the research department, by October 18. The Council's new address is Hookstone Road, Harrogate, Yorkshire.

FREDERICK W. EVANS, LTD.—A new extension to the company's works at Long Acre, Birmingham, has now been completed. The extension has enabled the reorganization and extension of the stores, together with the installation of a new moulding shop. This has increased the press capacity of the company.

AUSTRALIAN PLASTICS EXHIBITION.—One of the exhibitors at the "World of Plastics Exhibition" held at Sydney Town Hall during August was C.S.R. Chemicals Pty., Ltd., who in addition to their own moulding powder displayed the products of British Geon, Ltd., and British Resin Products, for whom they are the Australian agents.

C.S.R. Chemicals Display at Sydney.

ST. ERIK'S FAIR, STOCKHOLM.—Held in September, the St. Erik's Fair included a British pavilion in which a number of companies connected with the plastics industry was represented. These included: P. B. Cow and Co., Ltd.; Injection Moulders, Ltd.; Lines Brothers, Ltd.; Popular Plastics and Thurgar Bollé (Successors), Ltd.

OIL AND COLOUR CHEMISTS' ASSOCIATION.—Amongst the companies who will be exhibiting at the Seventh Technical Exhibition in March next year are Aero Research Ltd.; British Geon, Ltd.; British Industrial Plastics, Ltd.; British Resin Products, Ltd.; Hercules Powder Co., Ltd.; Imperial Chemical Industries, Ltd.; Midland Silicones, Ltd.; Monsanto Chemicals, Ltd.; Petrochemicals Ltd.; Scott Bader and Co., Ltd.; Shell Chemicals, Ltd.; Styrene Co-Polymers, Ltd., and Vinyl Products, Ltd.

SCOTTISH INDUSTRIES EXHIBITION.—Distillers Co., Ltd., Industrial Group were displaying on their stand examples of moulded polystyrene articles including cosmetic boxes and battery breather plugs. Also shown were corrugated roofing sheets and lightweight laminated tubing in polystyrene, and p.v.c. oilskins, fire-proof conveyor belting and tiles.

GERMAN PLASTICS TRADE FAIR.—The Plastics Trade Fair and Production Show, "Plastics 1955" will be held from October 8 to October 16, 1955, in Dusseldorf.

BRITISH INSULATED CALLENDER'S CABLES, LTD., have been exhibiting at the Purchasing Officers' Association "Minibition" at Harrogate. Their display included low-, medium- and high-voltage rubber and plastic cables.

FACTORY EQUIPMENT EXHIBITION.—The exhibition, the only one of its kind held in Europe, is to be held at Earls Court from March 28 to April 2. It is expected to be nearly seven times the size of the first exhibition held in 1953.

PATENTS AGREEMENT.—An agreement has been reached between Aero Research, Ltd., and Shell Chemicals, Ltd., covering the patents held by Ciba and Shell in the field of epoxide resins.

UNUSUAL PLASTICS DISPLAY.—British Geon, Ltd., exhibited its new travelling exhibition for the first time at the International Plastics Exhibition held in Oslo from October 5 to 17.

This display was specially devised to feature Breon p.v.c.—one of the major plastics raw materials—and to demonstrate its properties and wide range of uses.

Designed by Mr. I. W. Bradbery, M.S.I.A., the display was built and assembled for inspection in London, demounted, packed in eight crates and shipped to Oslo. At the International Plastics Exhibition it was erected in a few hours on Site No. 25.

The British Geon, Ltd., travelling display is of highly original design and is easy to build into a complete stand. It consists of separate unit display panels which are supported at each end by rectangular steel frames at right angles to the display; the panel ends simply fall into slots. A few separate half-unit panels are fitted flush on to the frame ends in the same way.

The assembled units, including cupboard units built up in a similar way, are appropriately arranged on the site and a curtain covering the entrance to a small office is put into position. Overhead electric wiring troughs and lights are fitted into place and the stand is complete.

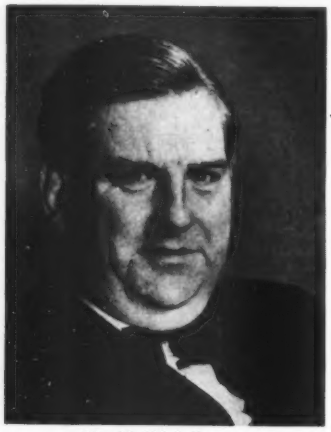
Each unit panel carries display material on both sides. Variety is given by treating each half-unit differently. Some halves contain three-dimensional displays featuring important groups of products made with Breon p.v.c. Others show typical products against background photographs illustrating their use.

British Geon, Ltd., new travelling display, seen at Oslo Exhibition in October.

A selection of trophies which are competed for by members of British Moulded Plastics Social and Sports Club.

BRITISH MOULDED PLASTICS SOCIAL AND SPORTS CLUB.—A fine selection of trophies are competed for by the members of the British Moulded Plastics Social and Sports Club, some of which are shown in the photograph. This club is a flourishing concern and embraces many sports and social activities. Trophies shown include the Inter-Staff Cricket Trophy, the Table Tennis Cup and the Darts Competition Cup.

NEW PLASTICS DIVISION.—James Mitchell and Son (Greenock), Ltd., have now formed a plastics division under the general managership of Mr. H. W. J. Pope. This development results from the considerable increase in the company's activities in the field of engineering plastics.



Mr. H. W. J. Pope.

BOWDEN (ENGINEERS), LTD., announce the appointment of Mr. S. G. McLeod as Works Manager of their Willesden factory.

MR. CHARLES WATSON.—British Ermeto Corporation, Ltd., announce the appointment of Mr. Charles Watson as director.

HELLERMANN LTD.—Mr. J. E. Earle has joined the company as sales representative. In addition, Hellermann Ltd., now handle all the sales of plastic extrusions made by the associate company, Cheltenham Plastics, Ltd. A new department has been set up, the plastics extrusion division, which will be in the charge of Mr. C. E. D. Catley. Mr. Catley remains as general manager of Cheltenham Plastics, Ltd.

MR. HARRY KLEEMAN has been appointed a director of Kleestron Ltd., as noted in our last issue. We regret that in that note he was referred to as Mr. Harry Kleestron.

NEW PUBLICITY CONTROLLER OF I.C.I.—Mr. B. W. Galvin Wright has been appointed publicity controller of Imperial Chemical Industries, Ltd., with effect from October 1 this year. As controller of I.C.I.'s publicity, Mr. Galvin Wright will have the assistance of Mr. Gordon Long, who will continue in charge of the public relations section, with Mr. Geoffrey Richards as press officer, and Mr. W. J. Marrable, who is in charge of the commercial advertising and exhibitions section.

MR. W. A. HARTOP, works director of George Kent Ltd., is on a two months' tour of Canada investigating further export markets for his company. He will also visit Kent-Norlantic Ltd., their Canadian subsidiary to assist in their production organization.

GOLF.—Results of the last meeting of the P.I.G.S. were:—"Artid" Trophy (Medal): won by Frank A. Garrett (5), 70. Runner-up: J. C. Brierley (12), 73, after a tie with T. W. Fassett (10). "I.C.I." Trophy (Scratch): won by F. A. Garrett (5). 75. "Rootes" Prize (Stableford Bogey Foursomes): winners: R. F. Johnson (8) and A. E. S. Matthews (9), 36. Runners-up: C. Parkinson (5) and J. Davis (13), 33, after a tie with T. W. Fassett (10) and B. Croxford (7).

"THURGAR" AT STOCKHOLM.—In our June issue, page 203, we reported the floating exhibition of Thurgar Bollé (Successors), Ltd., in the Motor Yacht "Thurgar," which during the British Industries Fair was moored off the Embankment. It subsequently left on its tour overseas and our photograph shows Count Bernadotte, second son of the King of Sweden, in the saloon on the occasion of the yacht's visit to Stockholm.

M.Y. "Thurgar" at Stockholm.

PLASTICS AT THE COMMERCIAL MOTOR SHOW.—On the stand of Dodge Bros. (Britain) Ltd., at this year's show was the "Plastic-Age" van body. Using for the first time, it is claimed, a new laminate produced by Warerite Ltd., with a metal mesh core, side, bulkhead and door panels of this material, which because of its great strength need only be $\frac{1}{8}$-in. thickness, are rivetted to a light alloy frame. The interior of the van is lined with standard Warerite sheeting. The roof and guttering is a one-piece moulding in resin bonded glass fibre reinforced by ribs of the same material and is bolted onto the metal frame. The rear wings and wheelbox are also formed of glass fibre laminate. The final use of plastics was in the flooring and tailboard which were made from a melamine surfaced laminate bonded to a special core. The roof and rear wings were manufactured by Bon-Glass Industries, New Romsey, Kent, and the bodywork made-up by University Commercials and Coachwork for L. F. Dove Ltd.

Arlington Bodybuilders Ltd., of Enfield, Middlesex, had on show a pantechnicon the body of which was made of aluminium alloy sheeting mounted on an extruded alloy frame. The roof was made up of sections of reinforced resin bonded glass fibre which had been left unpainted to allow light to enter the body of the vehicle. It was originally intended to construct the whole body of the van in this way but in order to exhibit it at this show the project had to be temporarily abandoned.

Plastics seat-backs in new bus.

The coachwork of the Reliant 5 cwt. was largely constructed from glass fibre. A full report is published on page 320 of this issue.

The new 64-seat double deck bus for London Transport is one of the first public service vehicles to use fibre glass in its construction. Wing valances and the bonnet top are made in this material as are also the seat backs. Glass fibre has been used in an effort to reduce weight and cost. The bus was on show at the stand of A.E.C., Ltd.

THE RADIO SHOW.—To mark this year's Radio Show, our monthly feature, "Plastics in the Service of Man," pages 322 to 325, has been devoted to the use of plastics in radio and television. The first two pages show a comparison between pre-war and post-war designs; it will be seen that the current trend towards simplicity has

been continued. There can be no doubt that pre-war design of moulded radio cabinets drew too heavily upon the traditional cabinets in wood, with the result that the inherent properties of the plastics materials themselves were not given opportunity of full development. The increasing part played by the industrial designer today is bringing about a radical change in design, and on the whole the results that are being achieved are creditable to the plastics and radio industry.

The material most frequently used is still the phenolic moulding powder although in the portable radio field there is a move towards polystyrene, and some very handsome effects have been achieved by the use of transparent grades of this material, spray painted on the reverse side.

It is certainly to the advantage of the plastics industry that public opinion be favourably inclined towards the moulded cabinet, since over 13 million radio sets have been produced since the war. A factor, worthy of consideration, is that recent years have shown a trend towards the greater sale of "popular" sets—those which have a maximum price of £23 10s., as distinct from the more expensive models. In 1953 80% of the sets sold fell within this price category, whereas in 1950 it was 68% only. It is in this popular field that plastics can help most, reducing the cabinet cost considerably in comparison with its wooden counterpart. In addition, in the portable field, the plastics cabinet has a powerful advantage in reducing the weight of the complete unit.

It would be true to say that this year's show was not remarkable for any spectacular development in the plastics field, but rather a consolidation of applications. One of the biggest moulders to the radio industry, British Moulded Plastics, Ltd., report that demands for cabinets are very heavy, and there are now few firms which do not offer at least one plastics cabinet in their range of sets.

One of the most novel introductions was the portable G.E.C. set, a 5-valve mains unit priced at 15 guineas, including tax. The use of polystyrene in the case has reduced the overall weight to 5¼ lb. An enhanced decorative effect has been obtained by spraying the inside of the case cream, so that an effect of depth has been achieved. On a larger scale, G.E.C. offer a 5-valve model at 20 guineas, which has a phenolic cabinet designed to simulate wood. This, combined with a modern style, has yielded a most effective unit.

The Marconiphone Co., Ltd., showed a number of new models incorporating plastics. Of these the most striking was the "Companion" receiver, moulded in maroon coloured phenolic material. The cabinet style, shown in page two of "Plastics in the Service of Man" manages to achieve an all-curved effect which is in keeping with the modern trend and most pleasing to the eye.

In the Sobell range of sets, extensive use is made of moulded materials, as well as woven flexible plastics for grilles. These sets combine natural and synthetic materials admirably, and achieve excellent colour contrasts. Ferranti also achieve an excellent effect with their radiogram in walnut relieved with bands of cream moulded urea.

For television, moulded plastics do not at the moment appear to have such great appeal as for radio. One of the few moulded cabinets for television is the Bush, in phenolic, by British Moulded Plastics, Ltd. It is of course true that the television cabinet is, on the whole, a larger structure than the average radio cabinet, but it is doubtful whether this alone is the reason why so few cabinets are moulded. The reason is more likely to be found in the fact that the television industry as a comparative newcomer to the entertainment field is changing set designs too frequently to warrant the high cost of tool manufacture, plus the fact that only in 1953 did radio and television manufacture reach an approximate parity. In 1952 1,232,000 radios were produced, compared with 812,000 television sets. The total production from the end of the war to June of this year was 13½ million radios as against 4 million television sets.

This is not to say, however, that plastics do not make an important contribution to the television industry. Widespread use is made of acrylics, rigid p.v.c., and polystyrene in T.V. screen surrounds. The screens themselves are frequently in similar materials, including a screen moulded from Cobex, rigid p.v.c. manufactured by B.X. Plastics, Ltd., incorporating a moulded-in Fresnal lens.

For both radio and television plastics are much used for the manufacture of knobs, accessories and programme dials. Polystyrene, urea and phenolic materials are the most widely used for knobs. For grilles, polystyrene is the most popular material, and Perspex for programme dials. A good example is the Pilot Radio "Little Maestro," on page four of "Plastics in the Service of Man." The cabinet and knobs are all moulded in polystyrene. On the same page another Pilot Radio set has the cabinet moulded in urea, with a polystyrene grille in clear material, gold sprayed on the reverse side.

Plastics in the Service of Man

The following is a list of full names and addresses of companies mentioned in the illustrated feature, "Plastics in the Service of Man," which appears on pages 322 to 325 in this issue:—

52. Radio and Television

Bakelite, Ltd., 12 Grosvenor Gardens, London, S.W.1.
Barclay-Stuart (Plastics), Ltd., 25 Brunswick Street, Luton, Beds.
Birkbys, Ltd., Liversedge, Yorkshire.
Bush Radio, Ltd., Power Road, London, W.4.
E. K. Cole Ltd., Plastics Division, Ekco Works, Southend, Essex.
A. C. Cossor, Ltd., Highbury Grove, London, N.5.
Defiant-Co-operative Wholesale Society, Ltd., 99 Leman Street, London, E.1.
Ekco—see E. K. Cole, Ltd.
Electric and Musical Industries, Ltd., Hayes, Middlesex.
H.M.V. Gramophone Co., Ltd., Hayes, Middlesex.
Halex, Ltd., Higham's Park, London, E.4.
Injection Moulders, Ltd., Westmoreland Road, London, N.W.9.
Kolster-Brandes, Ltd., Footscray, Sidcup, Kent.
Marconiphone—see E.M.I., Ltd.
Micanite and Insulators Co., Ltd., Blackhorse Lane, London, E.17.
Murphy Radio, Ltd., Welwyn Garden City, Herts.
National Plastics (Sales), Ltd., Avenue Works, Walthamstow Avenue, London, E.4.
Philco—see Philips Electrical, Ltd.
Philips Electrical, Ltd., Shaftesbury Avenue, London, W.C.2.
Pilot Radio, Ltd., Park Royal Road, London, N.W.10.
Punfield and Barstow (Mouldings), Ltd., Westmoreland Road, London, N.W.9.
Pye, Ltd., P.O. Box 49, Cambridge.
Radio and Allied Industries, Ltd., Langley Park, Slough, Bucks.
Regentone Radio and Television, Ltd., Mawneys, Romford, Essex.
Ultra Electric, Ltd., Western Avenue, London, W.3.

MEETINGS

October

15th.—"The Detection of Fine Art Fakes and Forgeries," Prof. P. D. Ritchie, B.Sc., Ph.D., F.R.I.C., F.R.S.E. Plastics Institute, Midlands Section, James Watt Memorial Institute, Gt. Charles Street, Birmingham. 6.30 p.m.

18th.—"Extrusion Machinery." Speakers: K. Baigent, "Multi-Screw"; E. G. Fisher, M.P.S., "Single Screw." Plastics Institute, London Section, Waldorf Hotel, Aldwych, London, W.C.2. 6.30 p.m.

19th.—"Recent Investigations in the Field of Vinyl Polymerization," Dr. C. H. Bamford. Society of Chemical Industry, Plastics and Polymer Group, Rooms of the Chemical Society, Burlington House, London, W.1. 6.30 p.m.

20th.—"Glass Fibre Laminates," C. Joseph. Plastics Institute, North-Eastern Section, Oak Room of Mining Institute, Neville Hall, Newcastle upon Tyne. 7.0 p.m.

20th.—"Plastics in Shipbuilding," speaker to be arranged. Plastics Institute, Scottish Section.

22nd.—Plastics Institute, Midlands Section, Autumn Dance at Botanical Gardens, Birmingham.

22nd.—"Injection Moulding Efficiency and the Importance of 'Gating.'" E. Gaspar, M.I.Mech.E. Plastics Institute, North-Western Section, Engineers' Club, Albert Square, Manchester, 2. 6.30 p.m.

26th.—Works visit to the Austin Motor Co., Ltd., Longbridge, Birmingham. Plastics Institute, North-Western Section.

27th.—"Plant and Equipment for Moulding Plastics," P. H. Young, B.Sc. Plastics Institute, Western Section, at Messrs. T. H. and J. Daniels, Ltd., Stroud, Gloucester. 6.30 p.m.

29th.—"The Application of Plastics to the Problems of Corrosion Resistance," V. Evans, M.Sc., F.R.I.C., A.P.I. Plastics Institute, Yorkshire Section, Joint Meeting at Huddersfield with the Huddersfield Engineering Society.

November

10th.—"The Use of Plastics in Floor and Wall Coverings," a member of the staff of Thos. De La Rue and Co., Ltd. Plastics Institute, Yorkshire Section.

10th.—"Krilium," lecture and film, R. C. Tincknell, Ph.D., A.R.C.S. Plastics Institute, South Wales and Monmouthshire Section, Newport Technical College, Newport, Monmouthshire. 7.0 p.m.

TALKING SHOP . . .

Cheaper Polythene. As announced in the News pages, the price of polythene has been reduced by 3d. per lb. to 3s. 2d. This is the second cut this year. In May the price was reduced from 3s. 9d. to 3s. 5d.

Between March, 1939 when I.C.I. first put polythene on the market, and 1951, the price dropped steadily from 15s. to 3s. 3d. The Korean War was responsible, through increase in basic raw material costs, for putting the price back to 4s. 3d. per lb.

This reduction will assist manufacturers in every field. Courlene, the monofil and multi-filament yarn manufactured by Courtaulds, Ltd., has undergone a similar price cut of 3d. per lb.

Even with increased supplies polythene is still difficult to get and in great demand. According to the *Economist* in its issue of September 13, plans are under way for a total capacity of 55,000 tons by early 1957. The material is also being made at the moment in many countries throughout the world and must be earning Imperial Chemical Industries Ltd., valuable royalties.

* * *

Do it Yourself. The second International Handicrafts, Homecrafts and Hobbies Exhibition held at Olympia recently showed how strong the "do it yourself" movement is. The cost of professional labour is now so high as to force a great many people to study the possibility of doing themselves jobs about the house that they would normally call in a builder or decorator to handle. Thomas De La Rue and Co., Ltd., had a most popular stand, demonstrating how the handyman can resurface walls and furniture with Formica.

* * *

Toys from Germany. Many readers will recall the very beautiful and frequently very cheap toys that came from Germany before the war. Before the 1914 war, the Germans had a near monopoly of toys, particularly mechanical ones such as railway trains.

A recent article in the *Financial Times* for September 13 describes the German toy industry today. In the Nuremberg area three quarters of the population earn their livelihood by making dolls. In the same town is also a highly mechanized industry, much of it plastics moulding equipment, for the production of toys. Some recent figures are given, showing that exports of toys from Germany to the U.K. have declined from £800.000 in 1951 to £320,000 last year. Germany's biggest customer at the moment is U.S.A., taking 20% of the products, followed, surprisingly, by Sweden which takes 16%.

* * *

Destroyer "Mothballed." Last month I recorded the cocooning of the Princess flying-boat. Now comes news of one of our newest warships, the Daring class H.M.S. Dainty, being laid up in a backwater. Completed last year at a cost of nearly £3,000,000, her guns and equipment, much of it secret, have been sealed in what is presumably a p.v.c. protective coating. What the cost of such a task is it would be difficult to say, but the quantity of p.v.c. used must be tremendous, and must surely constitute a major usage of the material if the policy of "mothballing" Admiralty vessels is to be continued.

* * *

Show Time. The end of August marks the beginning of the yearly round of shows. To the normal list this year has been added the Food Fair, and thus during the span of six weeks we had the Radio Show, the S.B.A.C. Display at Farnborough, the Food Fair and the Commercial Motor Show. At each one there was ample demonstration of the growing strength of the plastics industry. Of particular note to my mind was Farnborough, where progress in the use of plastics has been swift, even when compared with last year, and the Commercial Motor Show. At both could be seen the encroachment of plastics into the preserves of light alloys, evidenced at the Commercial Motor Show by the use of laminates in bodywork. At the moment the commercial vehicle field offers great promise to laminated plastics, particularly glass fibre structures impregnated with polyester resins. The quantity of bodies produced prohibits the use of press tools. This leaves wood and fabric structures, panel beaten aluminium and laminates. The first of these three cannot compare with the other two for strength and durability. The second is costly in the extreme; panel beaters are today among the most highly paid of manual workers. The third method offers a strong construction coupled with generally lower labour costs, and considerable flexibility in design. I shall be surprised if next year's Commercial Motor Show does not show even greater developments in this direction.

* * *

American Car Body in London. According to the *Birmingham Gazette* for September 10 the Cadillac Co. will be showing a prototype car with a plastic body at the Motor Show at the end of October. Although American manufacturers cannot sell cars in Britain, many will be very interested to see the latest trend in synthetic car bodies in the States. Although no details are yet available I assume that the material used is glass fibre.

* * *

Plastic Goal Nets. Widely reported in the National Press recently was the use by Charlton Athletic of goal nets coated with a white plastics material, presumably p.v.c. Manufactured by Mr. Roy Denne, these nets should give considerably longer life than the conventional type and will certainly be much easier to see. I should imagine that the method of manufacture follows that employed for the production of p.v.c. covered washing lines. This is the second time that plastics have made football history; readers will recall the white plastic football introduced last year which was claimed to be a vast improvement in foggy weather.

* * *

Biggest Glass Fibre Boat. A report from Washington in the *Birmingham Gazette* of September 20 described the 51 ft. military craft weighing only 10 tons. This would appear to be an advance on the 45 ft. launch described in *Plastics* last month and built by Halmatic Ltd., at Portsmouth. The American craft is claimed to be able to carry 5 tons of dry cargo in the hold 20 ft. long by 9 ft. wide. Builders say the boat is designed to be shipped in 15 sections and easily assembled in the water without special knowledge or special tools.

* * *

Scottish Industries Exhibition. Arnoplast Ltd., the well-known Glasgow plastics company attracted a large number of visitors to their stand at the Scottish Industries Exhibition. Two units which attracted particular attention were a bath 4 ft. long, and a smaller-than-average sink and draining board unit. Several were ordered by local Glasgow people, as well as the crofters in the more inaccessible parts of Scotland. Arnoplast found that one of the chief attractions of these fabrications was lightness in weight, saving considerably on freight costs.

* * *

Plastics Share Prices Up. On Wednesday, September 15, the share price index of the *Financial Times* was 143.1 for plastics. On July 21 it was 133.1, and at the end of 1952 93.9.

* * *

Reduced Stand Costs Announced for 1955 B.I.F.—A new basic charge of 4s. 6d. per sq. ft. for stand construction is announced by the British Industries Fair, Ltd. This will mean a considerable saving for most exhibitors on the smaller stands. Reduced charges for electrical fittings and installations and reduced administrative costs will also come into effect. The cost of space remains at 6s. 6d. per sq. ft., as in previous years. Greater efforts are being made to attract the general public, who will be admitted every afternoon from 2 p.m. and on one evening each week when opening hours are being extended until 9 p.m.

* * *

Ink for Vinyl Plastics. A note by the Scientific Correspondent of the *Financial Times* (issue of September 27) mentions a vinyl base gold ink, said to be untarnishable, for use in printing vinyl plastics. It can be used on both rigid and flexible grades. Details can be obtained from the manufacturers, Claremont Pigment Dispersion Corporation, 110 Wallabout Street, Brooklyn 11, New York.

PLASTIKON.

Education In The Plastics Industry

By R. R. ROLLES, B.Sc., F.R.I.C.

Chief Chemist, British Moulded Plastics Ltd.

EDUCATION is of paramount importance in the plastics industry. New industries cannot afford to stand still technically, and technical advances cannot be made or maintained unless there is a reasonable standard of general education and a good standard of special education amongst employees. It is apparent that where an industry has well-accepted educational and training facilities, the status of that industry's products is enhanced both at home and abroad. The plastics industry in this country is expected to expand rapidly in the near future and increasing knowledge and skill will, therefore, be required of the individual worker. In some areas of Western Germany attendance at plastics classes has been made compulsory for one day weekly, in the employer's time, in conjunction with apprenticeship schemes and, in view of German competition, this country cannot afford to lag behind.

Experience in the plastics moulding industry has indicated that, coupled with practical knowledge, a standard of education to that of the City and Guilds of London Institute final examination is desirable for general production staff and that further education to the B.Sc. degree or A.P.I. standard is desirable for technical and executive staff.

It is realized that the Universities cannot at the present time satisfy the demands of industry for graduates, and it is a fact, moreover, that many boys of school-leaving age are not in a financial position to attend a full-time course of even a short duration. The majority of boys at grammar schools leave at about the age of 16 with a sound basic education to G.C.E. standard and must at once attempt to earn their living. Boys are, however, able to study for technological qualifications in their spare time, and in this way the gap between the demand for, and supply of, qualified men is being narrowed.

Part-time education in the chemical and engineering industries has now been recognized as of great importance. Many chemical and engineering laboratories, for example, are staffed almost entirely by young people whose education since the age of 16 has been on a part-time basis. Employers give asistance by allowing one day off per week for studies, and in approved cases it is possible for the period of military service to be deferred for several years until the course has been completed.

The results of part-time courses have been extremely beneficial to industry. Education of any type not only improves a person's knowledge, but broadens his mind, develops his brain, increases his interest in his work and improves his personality. This quite obviously increases his value to his employer and makes him more eligible for promotion to responsible positions involving not only more interesting work, but in these days, of probably more importance to the individual, a larger remuneration.

The plastics industry has done much in the encouragement of education, and recently full-time courses have been instituted for the Plastics Institute Diploma and for the Associateship, in London and Birmingham respectively. During the war years, the Institute interested the leaders of industry and as a result compulsory part-time education was introduced amongst juniors in some laboratories. Apprenticeship schemes were adopted for engineers involving part-time attendance at classes which were started at many technical colleges throughout the country. The Institute played a leading part in the organization of the City and Guilds of London Institute examinations in plastics technology, recommending examiners and being strongly represented on the Plastics Advisory Committee. The Associateship of the Plastics Institute was introduced as a final qualification of a standard generally equivalent to a B.Sc. degree and care was taken to make it possible for all these qualifications to be taken by part-time students who possessed reasonable ability.

Colleges in various parts of the country have been encouraged to arrange special part-time courses in plastics technology and the status and salary of teachers appear to be extremely satisfactory. Equipment for practical work is available in most establishments arranging courses, such as in London, Birmingham, Manchester and Stroud, and was often provided as a result of finance made available by the Plastics Industry Education Fund. It is unfortunate, however, that students residing outside these areas have difficulty in acquiring practical knowledge.

The Plastics Institute realizes that much remains to be done, and to assist teachers further it publishes monographs and arranges conferences. It is recognized that the total number of students attending part-time classes each year is small and up to recently has shown a steady decline. Moreover, most students appear to come from laboratories and relatively few from technical and production departments. Education needs greater publicity, and employers and senior executives can play a great part by officially recognizing technical qualifications and giving practical encouragement to students. It is an unfortunate fact that in many organizations neither employee nor employer appreciates the value of any type of technical education, although in general there is real evidence of the interest taken by the industry as shown by its support of the Plastics Institute Education Fund, which provides training grants and other facilities.

The standard of ability of many candidates for the City and Guilds and Associateship examinations is not satisfactory. The percentage of failures is rather high and too many candidates pass by a small margin of marks, so that they can hardly claim to have mastered their syllabus.

The foregoing remarks indicate that there is scope for action not only by the Plastics Institute, but by employers, employees and the education authorities. In particular, it is hoped that employers will become acquainted with the facilities available and will encourage employees to take the appropriate examinations to the benefit of the whole industry.

Book Reviews

Chromium Plating, by P. Morisset, J. W. Oswald, C. R. Draper and R. Pinner.
Published by Robert Draper, Ltd., 83/85 Udney Park Road, Teddington, Middlesex. Price 78s.

Chromium plating although only 30 years old as a commercial proposition has developed into an important and integral part of our metal industries and is now established in the plastics industry. The authors of this work have used as a basic text M. Morisset's "Chromage," and on this have built a sound and comprehensive survey of all aspects of chromium electrodeposition. The combination of scholarship, practical knowledge and wide bibliographical resources has given an up-to-date work wide in range and exact in detail. Divided into six sections, covering the theoretical aspects of plating, the technique, properties and application of hard chromes, decorative plating and a miscellaneous section, it can, indeed, be said to be an invaluable work of reference. Under the above headings besides discussing production it deals with the ancillary processes of grinding, polishing, and machining and mention is made of costs and health risks to which operators may be subjected. Perhaps one of the best features is the large number of illustrations, diagrams, graphs and photographs which show clearly in picture form where text might easily confuse. To facilitate comparison, wherever possible, the units of measurement have been standardized and an excellent reference system is incorporated at the back of the volume. Toolmakers and mouldmakers will find this a useful and informative book on all aspects and problems of chromium plating.

Chemistry For Our Times, by Elbert C. Weaver and Laurence S. Foster.
Published by McGraw-Hill Book Co. Inc. Price 30s.

Mr. E. C. Weaver and Mr. L. S. Foster have written a text book rather than a work of reference. It would be useful for a student of chemistry and for the schoolboy requiring a foundation knowledge written in layman's language and illustrated by examples taken from his everyday life. Starting with a brief history of chemistry and some of the great names connected with it the reader is led into the multitude of uses in which chemistry is helping our everyday existence.

This volume is amply illustrated by photographs and diagrams and includes eight colour plates. The subject matter leads the reader from the structure of water to nuclear physics and in doing so gives a comprehensive general picture of the importance of the chemist in the structure of our civilization.

The Effects of Biaxial Strain on the Properties of Acrylic Sheet

By S. J. BARKER, B.A.* and A. W. BIRLEY, M.A., D.Phil.*

MANY of the uses to which acrylic sheet is put depend on the fact that it can be shaped when hot into a wide variety of forms. When shaped, the material is in some sort of strained state, as is shown by the fact that it tends to revert to its original dimensions on re-heating. This faculty of shape recovery suggests that the polymer molecules are being oriented in the direction of stretch and later have a tendency to disorient and retract again, which they will do if the temperature becomes sufficiently high. In shapings which involve a high degree of stretch, a considerable amount of orientation of the molecules may be "frozen-in" in this way. The work described here was done to determine the effects of varying degrees of orientation produced under the special conditions of biaxial stretching on the physical properties of unplasticized polymethyl methacrylate sheet ("Perspex" brand acrylic sheet). Data of a similar nature on other thermoplastics have been reported by other workers. Bailey (1) working with polystyrene investigated the effect of unidirectional tensile strain, imposed on the polymer above its softening point when it was in its "rubbery state." He found that tensile strength, elongation at break and the threshold crazing stress were greatly increased in the direction of the frozen-in strain, whilst the same properties measured in the perpendicular direction were reduced. (See also (2), (3).) These effects assist in the production of monofilaments and bristles (4) from polystyrene. Similar results on polymethyl methacrylates have been reported by Peukert (5).

A general theory of the effect of orientation on the strength properties of linear high polymers has been put forward by Hsiao and his co-workers (6) (7), and has been extended (8) to cover the effect of biaxial orientation. A maximum increase in tensile strength of 27-28% in the plane of orientation was calculated, in excellent agreement with results obtained on "Polyflex"† sheets.

A practical investigation of some of the consequences of such two-way stretching, or biaxial orientation, in acrylic sheet has been carried out by Axilrod, Sherman, Cohen, and Wolock (9). They examined tensile strength, elongation at break, stress and strain at the onset of stress crazing, threshold stress for stress-solvent crazing and resistance to weathering. "Lucite" HC 201 and "Plexiglas" 1A, which are general purpose grades of acrylic sheet, and the heat-resistant grades, "Lucite" HC 202 and "Plexiglas" II, were investigated. Biaxial strains, corresponding to linear extensions in two perpendicular directions of 50-59%, were obtained by a method very similar to that described below. It was found that the strain at the onset of stress-solvent crazing (benzene) was greatly increased, and that the tensile strength and secant modulus were little affected by orientation; the elongation at break was raised from 10% to 60%. Mikhailov (10) has measured the influence of orientation on the dielectric constant and loss angle, tan δ, as a function of temperature at 1,000 c.p.s. He found a shift to a higher temperature of the maximum in the tan δ vs. temperature curve.

Preparation of Biaxially Oriented Acrylic Sheet

Unplasticized "Perspex," in thickness $\frac{1}{4}$ in. and $\frac{1}{8}$ in., was cut into sheets 19 in. square, which were heated in a circulatory air oven at 165° C. (20 minutes for $\frac{1}{4}$-in. sheet, 12 minutes for $\frac{1}{8}$-in. material). To produce the two-way stretching, a sheet was removed from the oven and clamped over a circular hole cut in the top of a box which could be connected to a large evacuated tank. On making the connection, the sheet was sucked into the box to form a segment of a sphere. A former, which was essentially a 10-in.-diameter ring, was lowered into the box until it touched the still rubbery sheet; the vacuum was then released, permitting the sheet to collapse on to the ring like a drum skin (9). In this way 10-in. circles were made, quite free from surface faults. By marking a 1-in. grid on the surface of the sheet prior to the stretch-forming process, it was shown that the biaxial strain was symmetrical and uniform over the disc. Sheets of unoriented material for preparing control specimens were subjected to the same heating cycle as the oriented discs.

The term Stretch Ratio, which can conveniently be abbreviated to S.R., is used to characterize the state of orientation of these sheets, and is defined as the ratio of the original to the final thickness. Other workers (9) have expressed their results in terms of percentage elongation, L, which is simply related to the Stretch Ratio on the assumption that there is no change in volume, thus:

$$L = 100\,(\sqrt{S.R.} - 1)$$

Sheets were made with Stretch Ratios up to 7.7 and in thicknesses down to 0.037 in. The material in a highly stretched condition had a laminar appearance when broken, showing cleavage parallel to its surface. This effect became more noticeable with increasing Stretch Ratio, and the most highly strained material resembled mica in that it could be easily split with the thumbnail.

Tensile Properties

The specimens conformed to the specification A.S.T.M. D638-49T (11) except that they were of varying thickness,

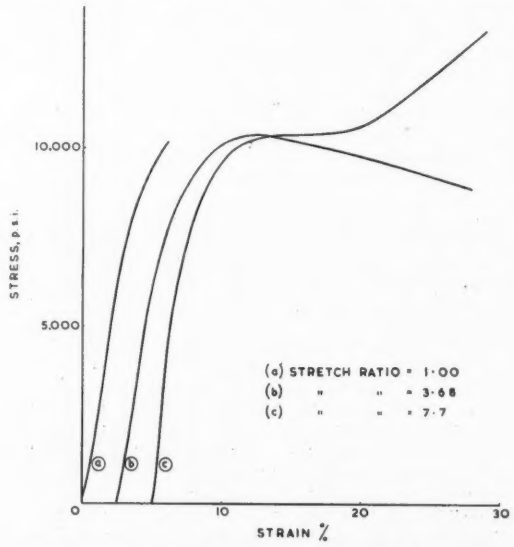
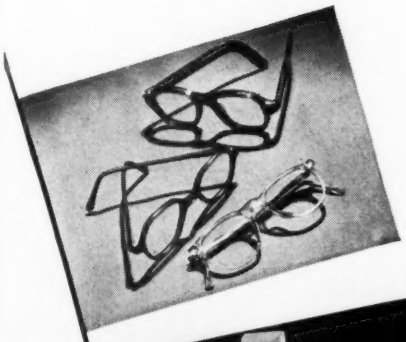


Fig. 1.—Each curve is displaced 2½% strain to the right of the previous one.

* Plastics Division, Imperial Chemical Industries. Ltd.

† Oriented polystyrene made by the Plax Corporation.



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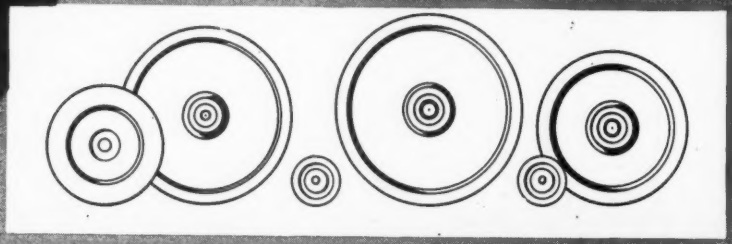

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according to the material available. The rate of testing was 0.050 in./min. and tests were carried out at 20 ± 1° C., and at various lower temperatures down to −20° C.

Three types of stress-strain curve were observed (Fig. 1):—

(a) That given by unstretched "Perspex" and characterized by a continuous increase of stress with strain up to the breaking point. This type is shown by "Perspex" with S.R. up to about 1.2 at room temperature, and by the other materials at lower temperatures.

(b) The type shown by "Perspex" above its "tensile brittle temperature" (V. infra), in which a yield point followed by a decrease of stress can be observed: this type is shown by biaxially strained materials with S.R. from about 1.2 to 5 at room temperature.

(c) That shown by the most highly strained materials at room temperature, in which a region of constant stress beyond the yield point is followed by a further increase of stress up to break.

The tensile strengths quoted in Table 1 are the stresses

Table 1

Maximum Strength in Tension of Biaxially Strained "Perspex"
Tensile Strength, p.s.i. x 10^{-4}

Stretch Ratio	Temperature °C				
	−20	−10	0	10	20
1.00	1.41	1.31	1.19	1.07	0.95
1.19	—	—	—	—	0.98
2.03	—	—	1.38	1.17	1.04
3.68	1.78	1.66	1.33	—	1.07
5.3	—	1.61	1.40	—	1.12
7.7	1.87	1.78	1.42	—	1.09 (1.34)

developed at the yield point, except for the figure in brackets for S.R.=7.7 at room temperature, which is the ultimate tensile strength; these were the only test pieces which showed stresses at break greater than the yield point values (as in (c) above).

A statistical analysis of even the room temperature results (20° C.) gives a value for the correlation coefficient which is significant to better than the 1% level, that is, there is a small but definite increase of tensile strength with Stretch Ratio; the increase at lower temperatures is more obvious still.

Young's modulus of elasticity was determined from tangents to the stress-strain curves at the origin. The data are given in Table 2. There is a small, but not very regular, increase in modulus with Stretch Ratio.

Table 2

Young's Modulus of Biaxially Stretched "Perspex"
Young's Modulus p.s.i. x 10^{-5}

Stretch Ratio	Temperature °C				
	−20	−10	0	10	20
1.00	5.70	5.25	4.95	4.55	4.15
1.19	—	—	—	—	4.35
2.03	—	—	4.90	4.7	4.20
3.68	6.85	6.05	5.40	—	4.30
5.3	—	5.50	5.40	—	4.60
7.7	6.65	5.80	4.95	—	4.65

Values of the elongation at break are given in Table 3. High strains at break, always associated with a yield point in the stress-strain curve, were observed with the oriented

Table 3

Extension at Break, %

Stretch Ratio	Temperature °C				
	−20	−10	0	10	20
1.00	2.0	2.2	2.5	3.3	4
1.19	—	—	—	—	6
2.03	—	—	5	13	15
3.68	6	8	16	—	20
5.3	—	7	16	—	21
7.7	6	7	11	—	21

materials at room temperature. No "necking" in the ordinary sense was observed, possibly because of the thinness of the specimens, but indentations occurred along the specimen edges, giving them a serrated appearance. In some specimens flow marks, starting from serrations and extending across the material at an angle of about 55° to its length, were observed. This would be the direction of zero extension for an incompressible material (12): similar marks are known to occur on thin metal specimens and are equivalent to "necks" in specimens of nearly equal width and thickness. The strains at break, though large, were less than those reported for "Lucite" and "Plexiglas" (9); the difference may be due to a variety of factors, including the lower test temperature.

There is a change in the tensile properties of ordinary unformed "Perspex" in the region 40-50° C. (13) characterized by the following:—

(a) Below a temperature of 40-50° C. the surface of the fracture has a rough appearance; above it, the fracture leaves a smooth surface;

(b) the strain at maximum load is greatest at this temperature;

(c) it is in the 40-50° C. region and above that the appearance of a yield point is observed.

The temperature at which these changes occur has been called the "tensile brittle temperature" (13). Comparable changes are observed in biaxially stretched "Perspex" at lower temperatures, except that the type of fracture does not alter; the other changes (b) and (c) do occur, however, at the temperatures noted in Table 4.

Table 4

"Tensile Brittle Temperature"

Stretch Ratio	Temperature °C
1.00	40 to 50
2.03	0 to 10
3.68	−10 to −20
5.3	−10 to −20
7.7	−10 to −20

Dynamic Properties

Dynamic moduli and mechanical losses have been measured by the "vibrating reed" method (14) (15), in which a thin strip of the material is clamped at one end and oscillated at its resonant frequency. The measurements were done at an essentially constant frequency, as this varied only from 145 to 165 c.p.s. at 20° C., and from 105 to 125 c.p.s. at 75° C. The data are given in Table 5.

Table 5

Dynamic Modulus in p.s.i. x 10^{-5}

Stretch Ratio	Modulus, 20°C	Modulus, 75°C
1.00	3.70	2.61
1.19	3.50	2.69
2.24	3.94	3.04
3.85	3.68	2.90
5.5	3.91	3.01
6.4	4.13	3.10

There is some suggestion from these results of an increase of modulus with increasing Stretch Ratio; this is particularly apparent in the results at 75° C.

Flexural Properties

Strength and modulus-in-bend determination have been made at room temperature over a range of S.R. from 1.0 to 5.5. The results show no significant variation of these properties with Stretch Ratio.

Impact Strength

This was measured by a falling missile test in which a 3-in. square of the material, supported on vertical rods with hemispherical ends disposed at the corners of an equilateral

triangle of side 6 cm., is hit repeatedly by missiles of successively increasing weights dropped from a height of 36 in. The impact strength is calculated as that energy at which 50% of the specimens survive. It is difficult to give a quantitative interpretation of the impact results in Table 6 as the thickness dependence of this property is not known. A

Table 6

Impact Strength in foot-pounds

S.R.	Number of Specimens	Mean Thickness ins.	Impact Strength ft. lb.	Standard Deviation ft. lb.
1.00	15	0.115	0.54	0.08
1.00	32	0.060	0.22	0.02
1.17	7	0.112	0.54	0.08
2.24	5	0.111	1.26	0.15
2.54	6	0.105	1.11	0.12
2.78	4	0.097	1.11	0.08
2.88	7	0.045	0.71	0.12
2.88	6	0.091	1.50	0.17
2.95	7	0.078	1.33	0.24
3.12	7	0.042	0.69	0.12
4.0	6	0.066	1.30	0.07
5.1	6	0.046	0.91	0.33
6.6	7	0.038	0.69	0.20

(thickness)^2 relationship has been found for "Perspex" (16), but that work covered no material thinner than $\frac{1}{8}$ in. The two results in Table 6 for S.R.=1.0 suggest that this law does not hold for thin material.

It is obvious from Table 6 that biaxial stretch-forming introduces a considerable improvement in impact strength

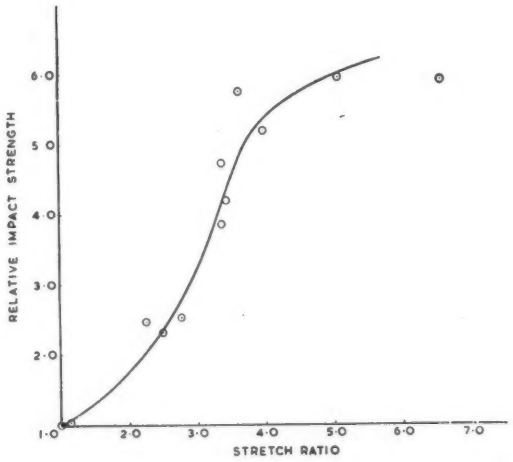

Fig. 2. Stretch Ratio/Impact Strength.

which increases 200-300% at S.R.=2.24 and 500-600% at S.R.=4.0, compared with the unformed material. Fig. 2 shows the variation with S.R. of the ratio of the impact strength of biaxially oriented "Perspex" to that of the unstrained material at the same thickness. The latter data has been calculated on the basis that impact strength is proportional to (thickness)$^{1.4}$, a figure chosen to make the two S.R. 1.0 values in Table 6 equivalent. Fig 2 included as a qualitative picture only, and too much importance should not be attached to the absolute values.

Table 7

Threshold Stress for Solvent Crazing in Ethanol

S.R.	Crazing Stress, p.s.i.
1.00	2850
1.17	2750
2.25	3850
4.8	5150
7.7	6750

Stress-solvent Crazing

The measurement of stress-solvent crazing on loaded cantilevers was not practicable since the most highly stretched material was too thin and flexible; instead, a wedge-shaped tensile specimen was used. The solvent used in the test was ethanol, applied continuously to the specimen under load for four minutes, and the threshold of crazing taken as the point at which a continuous crazed pattern appeared on the

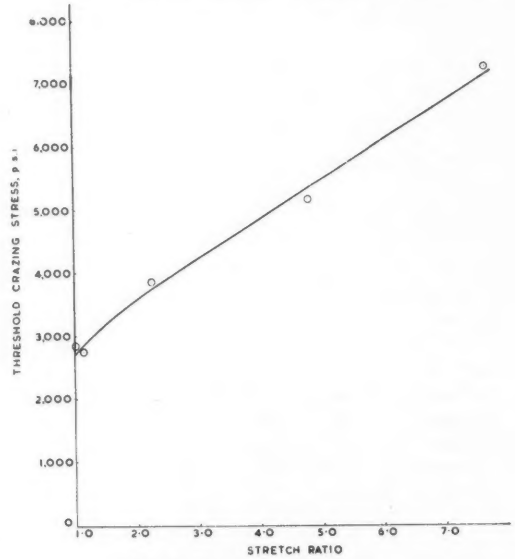

Fig. 3. Stretch Ratio/Crazing.

specimen. The results, each an average of two tests, are shown in Table 7 and Fig. 3. It will be noted that the most highly oriented material has a threshold crazing stress more than twice that of unformed "Perspex."

Thermal Properties

Specific volume v. temperature curves were determined over temperature range −38° to +100° C.; measurements were carried out using a dilatometer with mercury as the confining

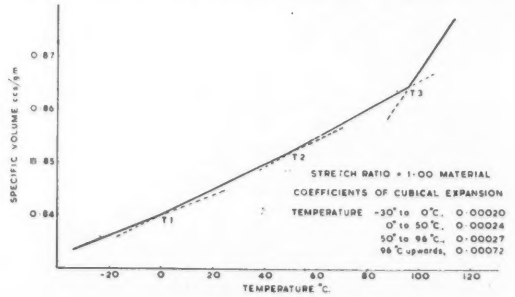

Fig. 4. Temperature/Specific Volume.

fluid; the temperature was raised at the rate of 0.5° C./min. All the samples examined showed volume v. temperature curves of similar shape. The curves showed no sharp discontinuities, but there seemed to be four distinct linear

Table 8

Transition Temperatures, °C

S.R.	T_1 °C	T_2 °C	T_3 °C
1.00	5	50	96
2.03	6	36	89
2.88	9	45	99
5.5	—	30	86
7.7	2	34	87

portions joined by smooth curves. It was thus possible to define three transition temperatures by extrapolating the linear portions until they met (Fig. 4). These temperatures are shown in Table 8.

T_3 is the second order transition temperature usually observed and associated with the rubber-glassy transition, and T_1 is to be identified with the transition reported by workers at the National Bureau of Standards (17). The transition temperature T_2, although not previously reported in the literature, was found with all five materials examined and is at least as prominent as that observed at T_1. With the exception of the S.R.=2.88 material, the temperatures of the T_3 transition are seen to be reduced from the values normally associated with "Perspex" (96-100° C.); this is what one would expect since oriented materials revert to unoriented sheet on heating.

The slopes of the specific volume v. temperature curves are the coefficients of volume thermal expansion. A comparison of these values with those obtained by a direct determination of the linear expansion (perpendicular to the plane of biaxial stretch-forming) indicates some increasing anisotropy in the material at increased Stretch Ratio.

Birefringence

It might be expected that the refractive index of the material in the plane of the sheet would be different from that in the perpendicular direction. Owing to the difficulty of cutting specimens perpendicular to the plane of the sheet, an absolute measurement of the birefringence was not possible: a factor directly proportional to the birefringence was measured, however, and this is plotted against Stretch Ratio in Fig. 5, which suggests that orientation is by no means complete in the strain range covered as there is no sign of a maximum in

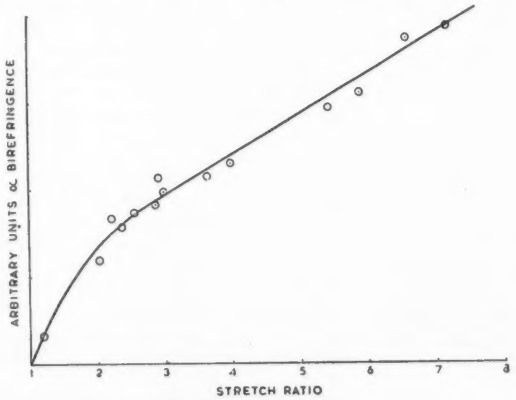

Fig. 5. Birefringence.

the curve. The birefringence is positive and small, that of the most highly strained material being about 4×10^{-4}. A qualitative consideration of the bond polarizabilities shows that such a small positive birefringence would result from orientation of the molecules in parallel to the plane of the sheet. X-ray diffraction photographs show no sign of three-dimensional order.

Discussion

There is considerable evidence for the existence of molecular order in "Perspex" which has been biaxially stretch-formed at high temperatures in the "rubbery" state and subsequently cooled, freezing-in the strain. X-ray investigations do not show the existence of three-dimensional order; other results, in particular the birefringence measurements and the mica-like fracture of the highly stretched material, suggest that the molecules are oriented to some degree in planes parallel to the plane of the sheet.

The effect of biaxial stretch-forming on some of the properties which have been examined seems to approach a maximum, in particular the elongation at break and the impact strength, where increase in Stretch Ratio beyond 3.0 produces little further effect. The measured birefringence, however, which we may assume to be related to the degree of orientation, shows no such behaviour, increasing steadily with increasing Stretch Ratio. The tensile strength and modulus are increased slightly as predicted theoretically by Hsiao (6, 7, 8). It has been shown that the tensile brittle temperature is reduced by biaxial stretch-forming with a consequent large increase in the elongation at break. The greatly improved impact strength can be readily understood in terms of the planar orientation of the molecules putting an increased fraction of the molecules perpendicular to the direction of fracture. The improved resistance of the planar oriented material to crazing might have been expected on theoretical grounds (6, 7, 8), since the more regular molecular arrangement allows a more complete spreading of tensile stresses in the material.

In some respects desirable properties are substantially improved by the biaxial stretch-forming process: impact strength and resistance to stress-solvent crazing are outstanding examples of these. The results are of interest since a certain amount of biaxial strain is introduced in many of the methods of fabricating "Perspex"; a small amount of biaxial orientation produced in this way may therefore be beneficial, and may partly compensate, for instance, for the greater thinning down of the "Perspex" which occurs at the places where this stretching takes place. Large amounts of biaxial strain unfortunately bring about a deterioration in some important properties: thus, dimensional stability at elevated temperatures is lowered, and the material develops a laminar structure which leads to flaking and splintering when pieces are machined. It may be, however, that in certain special applications a degree of biaxial strain can be employed which is adequate to produce a desired improvement in, say, impact strength, without too much sacrifice of other properties. These are possibilities yet to be explored.

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CITY AND GUILDS PLASTICS EXAMINATION RESULTS, 1954.

Results of the City and Guilds of London Institute Examination in Technology of Plastics held last spring are as follows, showing candidates who received first- and second-class certificates.

Intermediate.—*Borough Polytechnic*, 2nd class: M. J. Allan, E. T. Clifforth, D. E. Fiddes, P. H. Lynch, A. F. H. Pearce.

College of Technology, Birmingham, 1st class: L. Hadley; 2nd class: J. H. Atkins, D. W. Barr, J. D. Cappell, J. B. Hadley, M. G. Harwood, R. L. Hughes, M. A. Newman, M. A. Parsons, B. R. Sankey.

Stroud and District Technical College, 2nd class: G. L. Miles.

Newton Heath Technical College, 1st class: H. Gill, P. G. Wheeldon, M. H. Wraith; 2nd class: D. J. Brown, Barbara Hastie, J. L. Cooke.

National College of Rubber Technology, 2nd class: A. Ross, I. R. Hayward, D. Matthews, P. J. Morris, P. E. C. Davies, F. J. Somers, J. M. Barber, R. A. Wynn, H. G. Fitch.

Final.—*Borough Polytechnic*, 1st class: R. H. Hawker, I. L. Lewis; 2nd class: E. J. Pateman, T. N. Tarry.

College of Technology, Birmingham, 1st class: S. R. Cunliffe, G. B. Darby; 2nd class: A. W. Long, A. J. Newnes, N. B. Nicklin, R. Willis.

Newton Heath Technical College, 2nd class: F. Williams.

National College of Rubber Technology, 2nd class: H. Pyszora, D. J. Higgs.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. 8d. each (including postage).

B.P. 711,969. Method and apparatus for moulding discs of polyethylene or other bodies of thermo-plastic material on to an electric conductor or other core. R. W. Davies. To: British Insulated Callender's Cables, Ltd.

Discrete bodies of thermo-plastic material are moulded on to a core whilst the mould cavity reciprocates along the path of the advancing core. Injection takes place while the mould is stationary after one reciprocation or partly also when travelling forward.

B.P. 711,987. Cockpit hoods of aircraft. C. F. Wills. To: English Electric Co., Ltd.

The hood of transparent plastic is connected to the structure by tubular bolts loaded with an explosive charge to be detonated simultaneously.

B.P. 712,039. Resinous products. B. E. Mepham. To: Plastanol, Ltd.

Surface coatings (paints, lacquers, inks) by polymerizing styrene monomer in the presence of rubber transformation products.

B.P. 712,047. Manufacture of reinforced plastic material. F. C. Hester, C. A. Tierney. To: Polychemicals Developments, Ltd.

Stranded high-tensile steel wire having a loosely stranded cotton yarn between the wire strands made into a woven fabric. The polymerization of the plastic can be carried out by high-frequency induction heating as the main reinforcement is of metal.

B.P. 712,070. Stoppers. B.Z. Products, Ltd., W. L. Gaze.

The cup-shaped body and the head are mouldings of polythene welded together.

B.P. 712,084. Hose for conveying and spraying liquids. To: Josef Misch and Co. G.m.b.H. (Germany.)

The hollow liquid conveying part is formed with a base supporting the hose on the ground. The hollow part contains perforations for water jets. The hose may be made of synthetic resin material.

B.P. 712,113. Sorting apparatus. G. M. Baigent.

An arrangement of rods of glass or polymethyl methacrylate collect light reflected from an object and conduct it individually to a single photo-sensitive element.

B.P. 712,129. Production of films having a matt, porous and non-adherent surface. To: Badische Anilin-and Soda-Fabrik (I.G. Farbenindustrie A.G.). (Germany.)

For artificial leather prepared from pastes of polyvinyl chloride and a plasticizer. A moist mass is added which does not gel until heated.

B.P. 712,141. Plastic material bottle-seal or plug. G. Livas. (France.)

A hollow plug with an attached grip to be used with an ordinary screw cap.

B.P. 712,160. Racquets for games. W. J. Nye. To: H. J. Gray and Sons, Ltd.

Use of a resinous bond for racquets having a wooden head, a metal shaft and a built-up grip.

B.P. 712,191. Seaming of thermoplastic film. W. E. F. Gates. To: I.C.I., Ltd.

The film is passed from the feed roller to the take-off roller under such tension as to prevent creasing during the (radiant) heat-sealing operation but without impairing uniform seams.

B.P. 712,204. Shoe construction and method of making same. J. A. Ciaio. To: Snap-It Snug-Fit Shoe Machinery Co. Inc.

A three-ply construction with a closed pocket between the layers. The inner layer may be a thermoplastic or thermosetting screening (vinylidene chloride, etc.) into which a plastic solution (cellulose nitrate) is injected.

B.P. 712,219. Production of pigments. To: Badische Anilin-and Soda-Fabrik (I.G. Farbenindustrie A.G.). (Germany.)

Atomization of aqueous dispersions of powdered polymers or copolymers of vinyl chloride in a hot air current with solutions or suspensions of dye stuffs.

B.P. 712,235. Treatment of synthetic polymeric materials. R. Meyer, P. A. Garnier. To: Soc. des Usines Chimiques Rhône-Poulenc.

Dyeing of acrylonitrile polymers and copolymers.

B.P. 712,253. Toy. F. Perrin.

A bird of transparent plastic material on a slider.

B.P. 712,268. Treatment of synthetic polymeric materials. R. Meyer, P. A. Garnier. To: Soc. des Usines Chimiques Rhône-Poulenc.

B.P. 712,272. Containers for cakes of soap. L. Tyszkiewicz. A box with a pivoted lid and a grid raised into inclined position when opening the lid.

B.P. 712,310. Extrusion apparatus for plastic materials. H. F. E. Cirket.

The die box is inclined towards the cooling bath.

B.P. 712,313. Method of forming insulating coatings on elongated members and articles formed by such method. General Electric Co., Ltd., T. J. Curtis.

The handles of, e.g., domestic electric appliances are dipped into heated thermoplastic insulating material and removed from the fluid. The coating is then allowed to solidify.

B.P. 712,319. Copolymers, their production and products made therefrom. J. Downing, J. G. N. Drewitt. To: British Celanese, Ltd.

Copolymers of N-methyl maleimide with acrylonitrile. Films can be made by wet casting, shaped articles by moulding or hot solventless extrusion.

B.P. 712,367. Extrusion process and machine for the production of an insulating covering on an electrical conductor. To: Schweizerische Isola-Werke. (Switzerland.)

Helically wound threads of thermoplastic material in different colours. The orifices are eccentric to and revolve around the conductor. The material is fed from a stationary supply through also eccentric and revolving passages with individual feed screws to the corresponding orifices.

B.P. 712,408. Polyisocyanate modified polyester resin. To: United Aircraft Corp. (U.S.A.)

B.P. 712,448. Cigarette and cigar holder. H. Cooper.

A holder with two separate tubular mouthpieces for two persons to smoke simultaneously.

B.P. 712,494. Method of securing metal articles to thermoplastic materials. General Electric Co., Ltd., R. W. W. Sanderson.

Only the portions of the metal part and of the thermoplastic part in contact with each other are heated by high-frequency currents.

B.P. 712,510. Escutcheon fixing means. E. K. Cole, Ltd., F. C. Wilson.

An escutcheon of moulded plastic is fixed to the edge of a panel opening (radio receiver) by lugs formed during moulding and by bent leaf springs.

B.P. 712,568. Production of vinyl chloride polymer and plastisols therefrom. To: N. V. de Bataafsche Petroleum Maatschappij. (U.S.A.)

B.P. 712,706. Adhesion process. R. Stager. (Switzerland.)

The sticking of polyvinyl chloride shoe soles to a leather sole presents difficulties because the plasticizer of the resinous material penetrates into the adhesive and neutralizes its action. By first coating the resinous parts with a layer impenetrable by the plasticizer, this can be overcome.

B.P. 712,754. Rigid laminar articles of sandwich construction. R. J. Wareing. To: I.C.I., Ltd.

Refers to radomes having a lightweight core of expanded rubber and outer skins of woven glass cloth consolidated by a resinous bond of the polyester type.

B.P. 712,816. Fluid-liquid contacting device and process. P. D. Coppock. To: Distillers Co., Ltd.

A sheet of substantially rigid material with at least 25 apertures of $\frac{1}{16}$-in. to $\frac{1}{4}$-in. diameter (one aperture at least per square centimeter) as diaphragm. A flexible flap overlies each aperture. The diaphragm may be of metal or "Bakelite" or other plastic material inert to the fluids.

B.P. 712,820. Compositions comprising softening agents. H. Newby. Comm. from Chemische Werke Huls G.m.b.H.

Compositions from polyvinyl chloride or interpolymers containing vinyl chloride and softening agents obtained by diluting the usual softening agents in certain oily condensation products which replace part of the valuable softening agents. This not only reduces the costs but can produce an excellent floor or wall covering, a leather substitute, a rug or a material for similar use.

B.P. 712,838. Printing on polythene or like plastic substance to which printing inks adhere poorly. F. W. Stoyle. To: B. Winstone and Sons, Ltd.

A film of a transparent substance (a silicone wax or oil) is applied over the ink film after printing, to which substance pressure-sensitive adhesive and water-moistened types of adhesive tapes and paper do not cohere.

B.P. 712,852. Manufacture of fluid-flow metering devices. D. A. Jones. To: Girling, Ltd.

The accurate production of metering holes of substantial length and very small diameters (0.005 to 0.01 in.). Difficulties of forming the holes are overcome by moulding a thermoplastic or thermosetting material around a removable core wire. Acrylic resins, polyamides and phenol-formaldehyde resins are mentioned.

B.P. 712,859. Method for embedding a hollow needle in synthetic material. R. W. Ogle (U.S.A.).

The needle is mounted on a small mandrel a portion of which projects and is driven into the closed neck of the barrel of the syringe made from polyethylene. The needle is driven into, but not through, the neck, expanding the opening. Finally, the mandrel is driven through the neck to form a passage between barrel and needle. The mandrel is then removed.

B.P. 712.860. Disposable syringe. R. W. Ogle (U.S.A.).

B.P. 712,861. Injection syringe. E. Lindemann.

A transparent barrel of polystyrene or acrylic-acid ester fitted with upper and lower screw caps. Plunger, rod and knob are also made from a plastic material moulded as a single unit.

B.P. 812.882. Containers for tooth-paste, paint, ointment, or other pasty material having a piston-extrusion device. J. M. M. van Doornik (Netherlands).

The cap is extended into a rod so that the cap when removed may serve for displacing the piston closing the container at the bottom.

B.P. 712 939. Method of moulding hollow bodies from heat-hardenable artificial-resin masses and bodies so moulded. To: CIBA, Ltd. (Switzerland).

The resin is spread in a flowable condition on the inner wall of a rotating hollow mould by centrifugal force and is hardened by heat. By this method bodies of uniform and relatively large internal diameter throughout can be made with smooth internal and external surfaces. A number of suitable plastics is mentioned (polyhydric alcohols or phenols, phenoplasts, aminoplasts, etc.).

B.P. 712,940. Manufacture of bearings from plastic material. To: Cie Générale d'Electricité (France).

The bearings are made in two polymerization periods, first after a preliminary moulding operation of two component parts, then in a final polymerization operation uniting the parts in a common mould under heat and pressure. The bearings are intended for guide pulleys in belt conveyors to replace costly ball bearings.

B.P. 713,007. Extrusion of thermoplastic material. J. Allan, A. Stephens, D. W. Browne. To: British Celanese, Ltd.

The die block has a peripheral groove for trapping any thermoplastic material seeping forward over the outer surface of the die block. The trapped material is carried off through a drain passage provided, downwards through the die holder. The die head is particularly suitable for the hot, solventless extrusion of tubes of plasticized cellulose acetate, and also for the extrusion of polystyrene, polyethylene, polyvinyl chloride, etc.

B.P. 713,010. Plasticized compositions. M. H. Dilke, D. Faulkner, S. Lustigman. To: Distillers Co., Ltd.

Dimethyl phthalate and dimethyl tetrachlorophthalate are excellent plasticizers for vinylidene chloride polymers and copolymers.

B.P. 713,021. Artificial teeth. W. Rauscher.

An artificial tooth with a root which, at least in its outer layer, consists of synthetic material which is tolerated by the tissues constituting the human jaw. Such a tooth implanted into the jaw becomes firmly secured after eight days to permit mastication. The outer layer may be polyethylene while the core is a hard substance (synthetic material, ivory, metal).

B.P. 713,057. Goggle assembly. A. F. Parmelee. To: Parmelee Plastics Co.

Interconnecting means for shield and frame so as to facilitate removal of the shield for replacement or cleaning.

B.P. 713,091. Scoops. L. J. Wellings. To: W. G. Macnamara, Ltd.

For handling powders, pastes or liquids; may be moulded from a plastic with a spoon-shaped head and an extension forming a channel which may serve as handle or spout.

B.P. 713,174. Flame-resistant insulated conductors. R. A. Schatzel. To: Rome Cable Corp.

A metal core surround with a composition applied directly thereon which comprises 60% to 90% polyethylene and 10% to 40% of a mixture of an organic chlorinated compound, antimony oxide, a stabilizer, lubricant and plasticizer.

B.P. 173,184. Plastic welding device. R. S. Arkless. To: Telegraph Construction and Maintenance Co., Ltd.

A rod of thermoplastic material for welding a similar material is fed through a tube to a heated extrusion nozzle by a feed device engaging the side of the rod through a lateral aperture in the tube.

B.P. 713,187. Electric storage batteries. Oldham and Son, Ltd., J. R. Martin.

Tubular-type positive plates for lead-acid batteries or accumulators in which the individual tubes or plate sections are formed from plastic moulded channel sections cemented together along their longitudinal edges. Spaced, parallel, transverse ribs define slots for exposing the active material.

B.P. 713,200. Manufacture of plastic films or sheets. To: Union Carbide and Carbon Corp.

From a normally solid polymer of ethylene by heating, calendering and stretching.

B.P. 713,203. Apparatus for wrapping ribbons, laces and other materials. To: Cellophane Soc. An. (France).

B P. 713 232. Production of lacquer resins. E. von Eben-Worlée, H. von Eben-Worlée, E. H. Worlée and Co. (Germany).

One or more natural resins are melted together with one or more (co-)polymers of acrylic (methacrylic) acid and/or carboxy derivatives thereof. The product is then esterified with a polyhydric alcohol.

B.P. 713,240. Brushes. L. R. Bressler.

A one-piece moulded head, e.g. of polythene, with a number of bristle-carrying equal sections connected by thin resilient fins along the centre of the thickness of the head.

B.P. 713,248. Multi-colour printing. W. H. Hogg. To: Dunlop Rubber Co., Ltd.

Rollers or blocks are formed from a synthetic nitrile rubber blended with a polyvinyl compound and a pigment.

B.P. 713,332. Unsaturated polyester resins. B. Parkyn, E. Bader.

"Air inhibition" (permanent surface tackiness remaining after curing) can be eliminated by incorporating small quantities of various waxes or wax-like substances.

B.P. 713,350. Compression moulding of powdered materials. E. W. Reissner. To: Factories Direction, Ltd.

Dished or cupped mouldings of non-uniform thickness are obtained in two stages by first preforming the material to a shape different from the final shape so as to permit the control of the degree of compression in different parts of the mould (equal compression or variations of density).

B.P. 713,368. Circular saws. Slack Sellars and Co., Ltd., J. A. Greenwood.

To produce a clean cut in plastics, particularly in "Perspex" and non-metallic laminated materials. The saw with unset teeth alternately bevelled at the top is characterized by a slightly (0.03 in.) greater diameter of the cutting circle of the bevelled teeth than that of the straight-edge teeth. The blade is hollow ground on both side faces to provide clearance in the absence of any "set." Radial slots may allow for expansion by heat. The rake angle depends on the material to be cut (for "Perspex," minus 2° to zero).

712,369. "Mouthpiece" for the protection of the teeth and to cushion transmission of shock. J. F. Cathcart, F. P. Moffett (U.S.A.).

For those engaged in sport to protect the user against dislocation or injury.

B.P. 713 382. Spinning pot. To: Industrie-Werke Karlsruhe A.G. (Germany).

With a lining of synthetic resin for protecting the internal surface of the light-metal shell against chemical and mechanical action.

B.P. 713,419. Production of hollow moulded articles from thermoplastic material. Lacrinoid Products, Ltd., R. Hagen.

A bottle is formed by extruding tubular material over a nozzle through which fluid under pressure is passed after a portion of the tube has been enclosed in a two-part mould around the nozzle. The mould pinches and seals the tube at the other end so that the fluid pressure causes it to conform to the mould.

B.P. 713,434. Capacitors and the manufacture thereof. A. G. Kalstein, W. Kameron. To: Aerovox Corp. (U.S.A.).

Electrostatic capacitors of the rolled or tubular type are made with an impregnant comprising a copolymerized poly-unsaturated alkyd resin and styrene.

B.P. 713,437. Soothing teat for babies. F. Aspden.

B P. 713,499. Electric disc-type condensers. To: Siemens and Halske A.G. (Germany).

Use of an electrically conductive varnish (synthetic resin) as binding agent in high-frequency (wireless, television) apparatus.

B P. 713.521. Machine for the production of containers filled with liquids or pastes. L. Rado (France).

The filled thermoplastic (polyvinyl chloride) tube is compressed transversely between two heating elements which, at the

commencement of the pressing operation, are at a temperature below the softening point of the tubing. During this operation a controlled degree of heat is applied to unite the walls of the tubing where they are in contact. A support moves in step with the tubing and the elements, determining the length of the container.

B.P. 713,543. Method and apparatus for producing an open-mesh unwoven fabric and products thereof. G. Slayter, W. W. Drummond. To: Owens-Corning Fiberglass Corp.

Thermoplastic and thermosetting resins may be employed in bonding warp and fill strands of glass and other fibres, to form reinforcements for resin films, moulded plastics, and laminates.

B.P. 713,572. Capacitors. W. E. R. Evans. To: Standard Telephones and Cables, Ltd.

Before sealing, the capacitors are impregnated by a thermosetting mixture of resin, hardener and plasticizer cured, after the impregnation, together with the sealing mixture.

B.P. 713,573. Lamp shades made from thermoplastic material. Waite and Son, Ltd., P. W. Strutt.

A preformed conical shade is placed between a mandrel and a former for "waisted" cone-type shades. The mandrel is heated to soften the shade, then fluid pressure is applied to the inside of the softened shade to force it outwardly against the former.

B.P. 713,593. Process for making "cire-perdue" moulds. To: Régie Nationale des Usines Renault (France).

The coated (with the refractory filling) wax model is impregnated with an alcoholic Bakelite solution.

B.P. 713,627. Production of containers made from thermoplastic material and filled with fluid substance. L. Rado (France).

B.P. 713,629. Container filled with fluid substance. L. Rado.

The container material is preferably polyvinyl chloride.

B.P. 713,634. Manufacture of polythene-metal foil laminates. Venesta, Ltd., A. C. Brown, T. H. Angel.

The polythene is heated in the presence of free oxygen until it has acquired the property of adhering to the metal foil. Then both are contacted at a temperature above the melting range of polythene.

B.P. 713,668. Plugs or stoppers for the outlets and trap pipes of sinks, washbasins and baths. R. S. Gill.

A collapsible chamber is incorporated in the plug.

B.P. 713,681. Curtain rails. A. Boot. To: Capon Heaton and Co., Ltd.

The rail is made from a plastic material and has a bead along the edge or edges in which a wire reinforcement is embedded.

B.P. 713,702. Expanded polyvinyl chloride plastic containing wax. To: Wingfoot Corp. (U.S.A.).

For lifesaving equipment owing to its improved compression set so that it does not lose its buoyancy. Also as motor and instrument mountings, carpet underlays, gasket materials.

B.P. 713,706. Light-diffusing screens. M. Kilemnik (France).

Moulded plastic light-transmitting panels angularly adjustable to each other and aligned with further sets of panels to form a continuous screen. The panels may be made from luminescent or fluorescent plastic material.

B.P. 713,707. Manufacture of pipes. C. de Ganahl (U.S.A.).

Glassfibre rovings impregnated and coated by an unpolymerized liquid plastic composition, then heated to set the plastic. Each pipe section is made with a ring for securing an effective grip when removing it from the mandrel on which it was formed.

B.P. 713,841. Production by extrusion of thin-walled seamless tubes of thermoplastic materials. W. Berry, C. R. Oswin, J. A. D. Ewart, E. K. Ham. To: British Cellophane, Ltd.

More uniform wall thickness (0.0015 in. up to 0.02 in.) is obtained by providing the extruding die with a flexible circular external lip and a coaxial pin inside the die with a rigid circular internal lip, both lips bounding the annular extrusion orifice. The flexible lip is adjustable.

B.P. 713,871. Phenolic resin bonded tubing. To: Westinghouse Electric International Co. (U.S.A.).

A wrapped laminated tube of paper to which a binding phenolic resin is applied with a density of over 1.3 and low moisture absorption. When a certain combination of two varnishes is used the tube may be cured in an oven without pressure. The product is comparable to the best moulded tubes.

B.P. 713,884. Method of dyeing structures comprising the acrylonitrile polymers. To: Chemstrand Corp. (U.S.A.).

It was found that articles showed deeper shades and were dyed throughout their cross-sections when the usual sulphuric acid in acid dyes was replaced by nitric acid.

B.P. 713,905. Filling agents for suspensions of polyvinyl resins in plasticizing agent. To: Diamond Alkali Co. (U.S.A.).

B.P. 713,914. Surface colouring of regenerated cellulose. To: N.V. Kunstzidjesspinnerij Nyma (Netherlands).

A metallic pigment layer (text or figures) can be applied to moist regenerated cellulose by dispersing the pigment in an alkaline solution of hydroxy ethyl cellulose, printing with this dispersion, then precipitating the layer by an acid coagulation bath.

B.P. 713,927. Vehicle means for sound or signal records. F. Steube.

A thin (0.2 or less mm.) preformed sheet of, e.g., polyvinyl chloride is placed on a spacer in a moulding press under an embossing die. The usual guide grooves of records are produced in form of small creases or recesses in the preformed sheet.

B.P. 713,990. Process for making printing plates. To: "Straba" Handels-A.G. (Italy).

Plates of unsaturated polyester resins. The matrix for casting the liquid resin is made of a sheet of thermoplastic material.

B.P. 714,000. Slide fastener. R. Podolsky (France).

Two bands of a plastic material with longitudinal ribs and grooves of identical shape (mushroom section).

B.P. 714,067. Pneumatic diabolo. P. Delo.

B.P. 714,092. Process for coating wire. To: Standard Telephone and Cables, Ltd. Comm. from: Sumitomo Electric Industries, Ltd.

Coating with a solution of a polyvinyl acetal resin containing in suspension a polymer of furfural, then baking the wire.

B.P. 714,099. Inflation valve. A. R. Spidy. To: Walter Kidde Co., Ltd.

A mouth valve for life-jackets. Nylon for part of the mouthpiece prevents burning of the lips in extreme cold. The casing to be attached to the jacket is a tubular nylon moulding.

B.P. 714,194. Apparatus for the extrusion of thermoplastic material. W. Berry, R. A. Rose, J. A. V. White. To: British Cellophane, Ltd.

The extrusion orifice is provided with a plurality of spaced pockets with means for independently regulating their temperature and thence of portions of the lips of the orifice contiguous thereto. The passage of the hot extruded tube over a much cooler mandrel improves the clarity of the tube and renders the diameter more uniform.

B.P. 714,204. Method of making square-bottomed bags. H. Pound. To: E. S. and A. Robinson, Ltd.

Preferably made of heat-sealing plastic material. A length of tube is flattened and one end folded to form two triangles. After folding, free corners of the triangles are cut off and these, with the overlap, are sealed.

B.P. 714,214. Fire-retardant cellulose and cellulose ether bodies and compositions for use in producing the same. To: Monsanto Chemical Co. (U.S.A.).

A reaction product of phosphorus oxychloride and ammonia is uniformly dispersed in the basic composition.

B.P. 714,239. Manufacture of acrylonitrile polymer pastes. To: Farbwerke Hoechst A.G. (Germany).

Pastes containing a minimum quantity of 85% of the acrylonitrile component can easily be manufactured at room temperature by swelling the polymer in anhydrous hydrogen fluoride.

B.P. 714,250. Stiffener device for collars. H. U. Israel, H. Seabrook. To: Rael-Brook, Ltd.

Made from plastic sheeting.

B.P. 714,271. Brassieres. To: Escora-Corset-Fabrik Eduard Schmidt G.m.b.H. (Germany).

The bust-supporting parts are of a layered material in the form of a plastic foil (e.g., polyvinyl chloride) with fabric on each side.

B.P. 714,275. Manufacture of moisture-proof heat-sealable films. W. Berry, R. A. Rose, J. S. D. Pearce. To: British Cellophane, Ltd.

A superior slip agent is formed by adding a small proportion of finely divided polyvinyl chloride and copolymers to the ester-type wax previously used as slip agent for vinylidene chloride copolymer coatings and films.

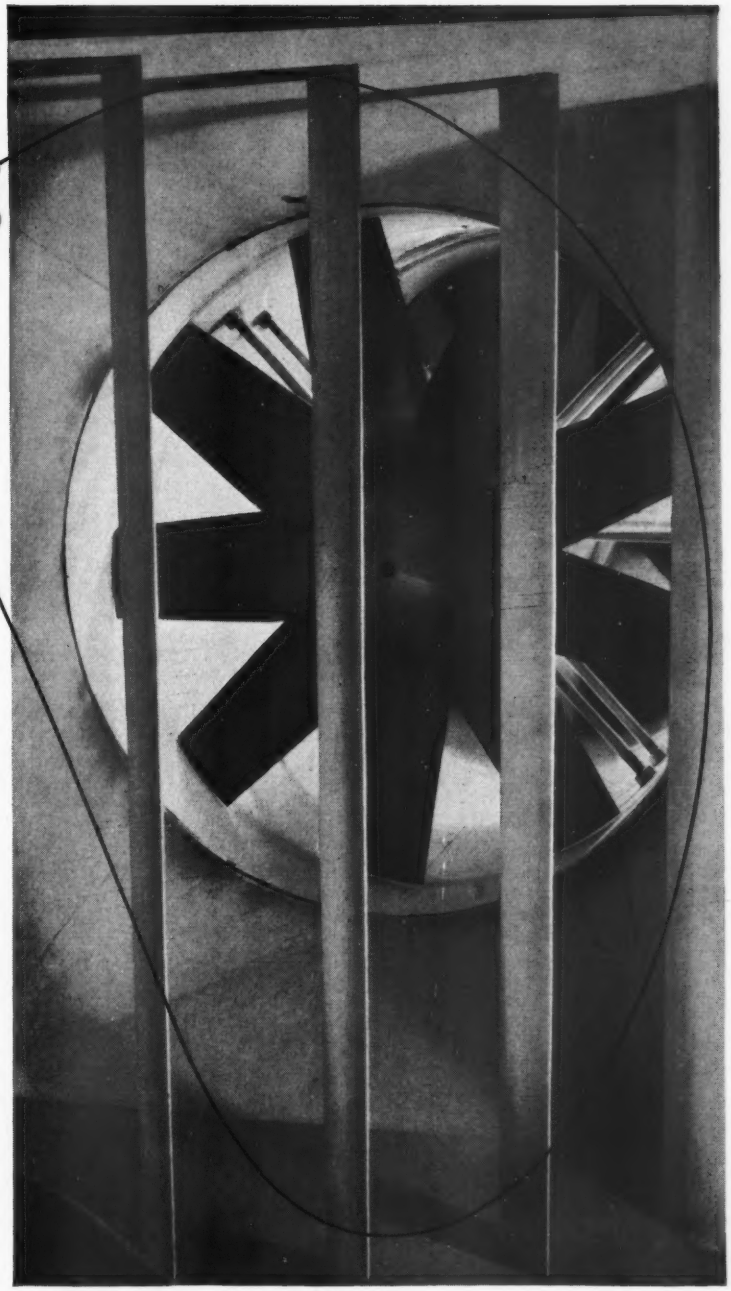
B.P. 714,414. Production of thermoplastic compositions. W. Saul, T. J. Wiggins. To: Semtex, Ltd.

Units for wall facings and floorings made from a composition including a filler and a two-phase binder, one a fusible resin, the other a (natural or synthetic) rubber which may be replaced by a copolymer of styrene with a minor amount of butadiene.

B.P. 714,432. Manufacture of vinyl copolymers. To: Lewis Berger and Sons, Ltd. (U.S.A.).

For coating compositions.

Harnessing the air



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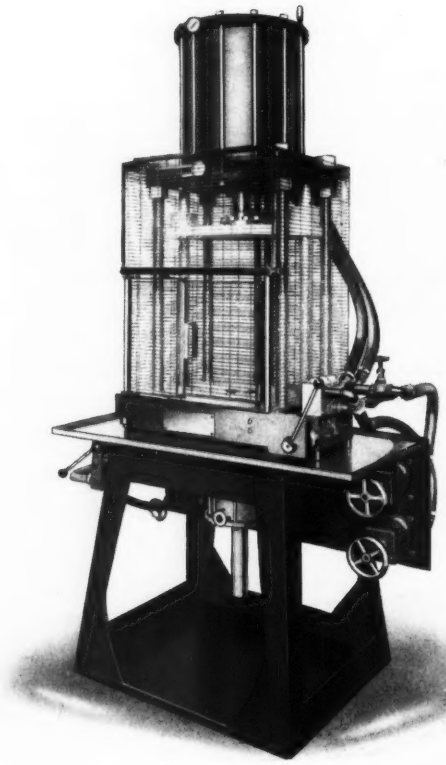

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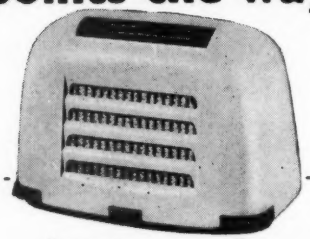

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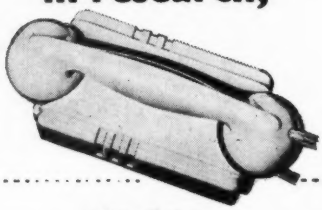

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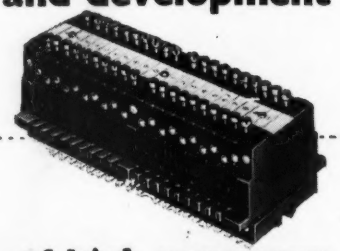

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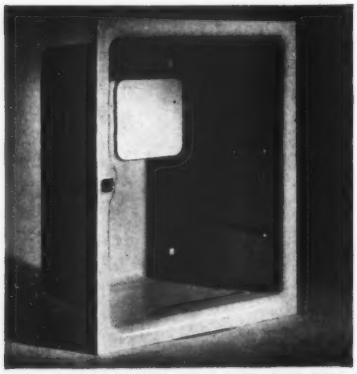

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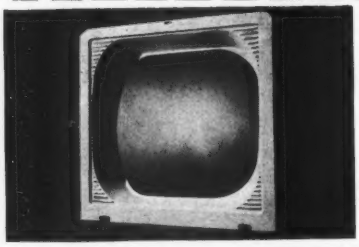

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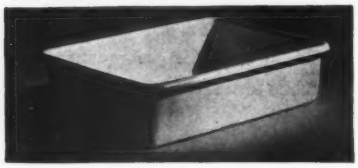

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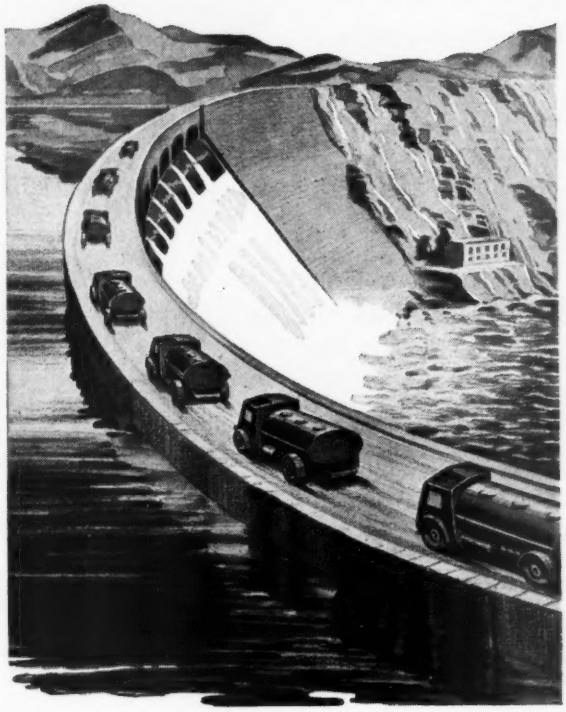

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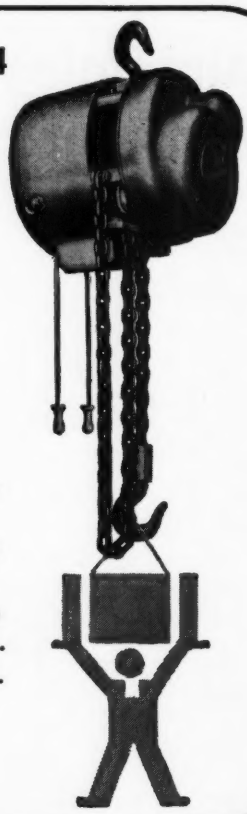

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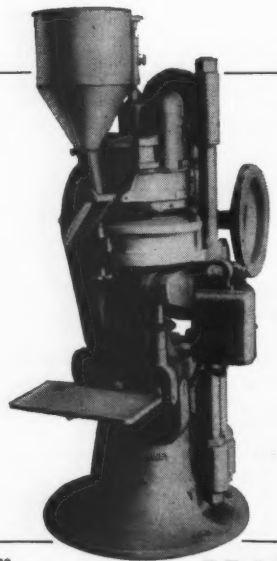

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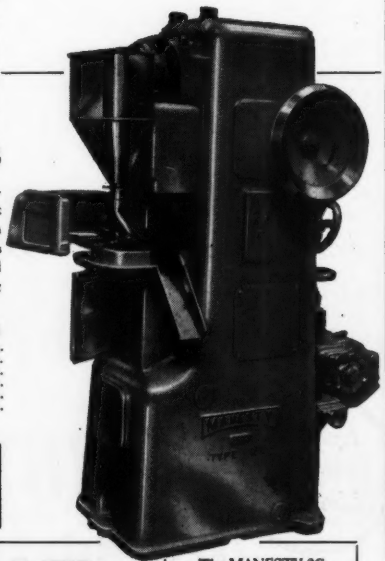

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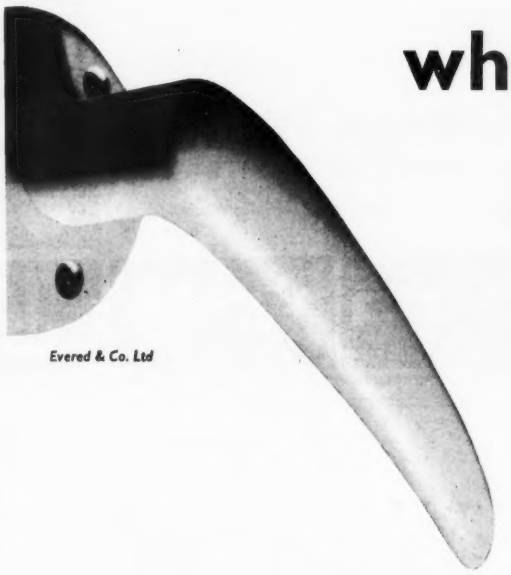

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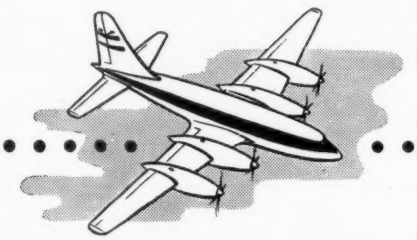

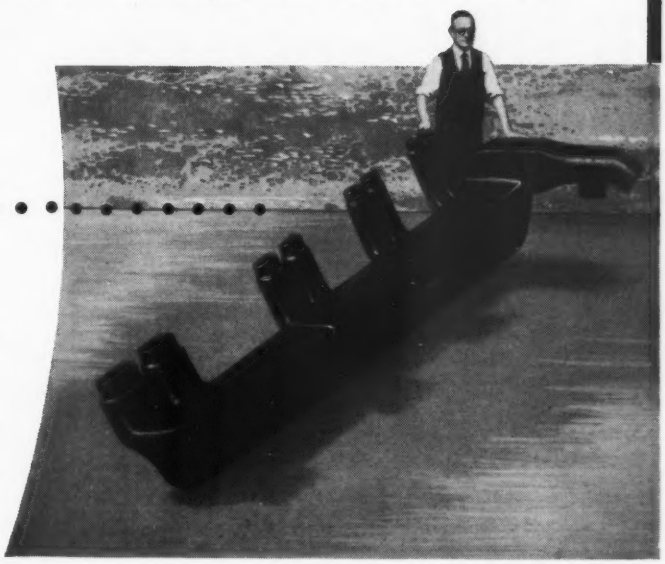

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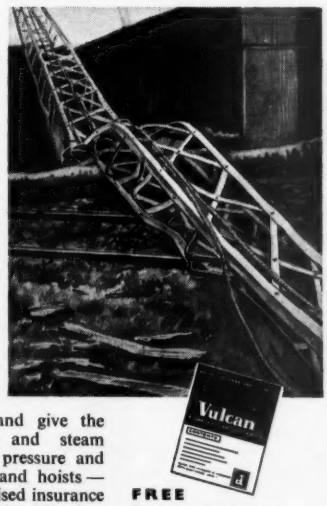

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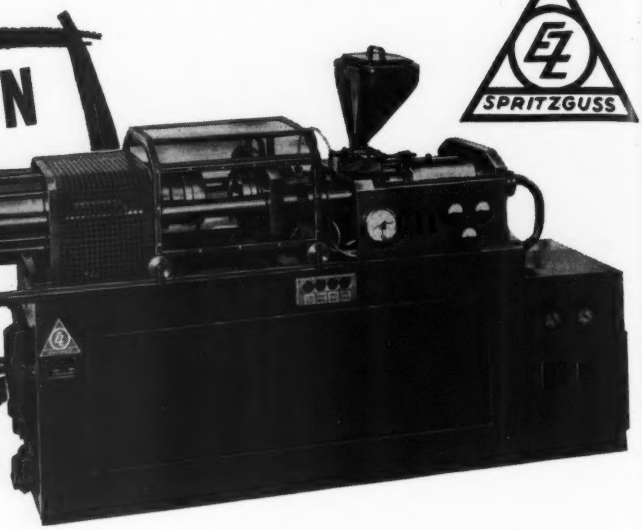

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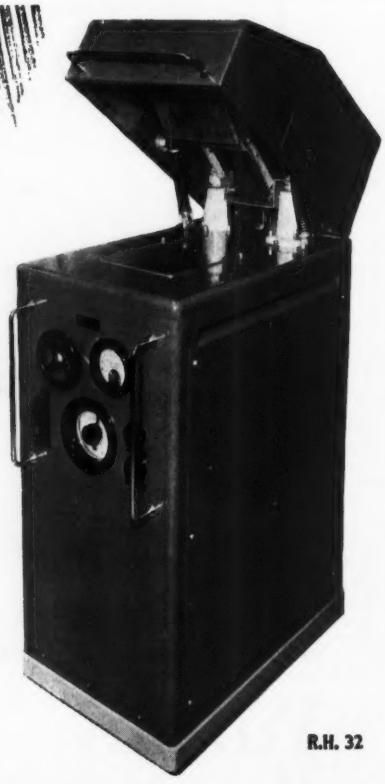

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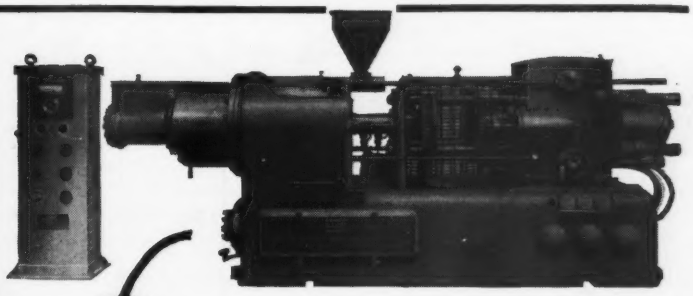

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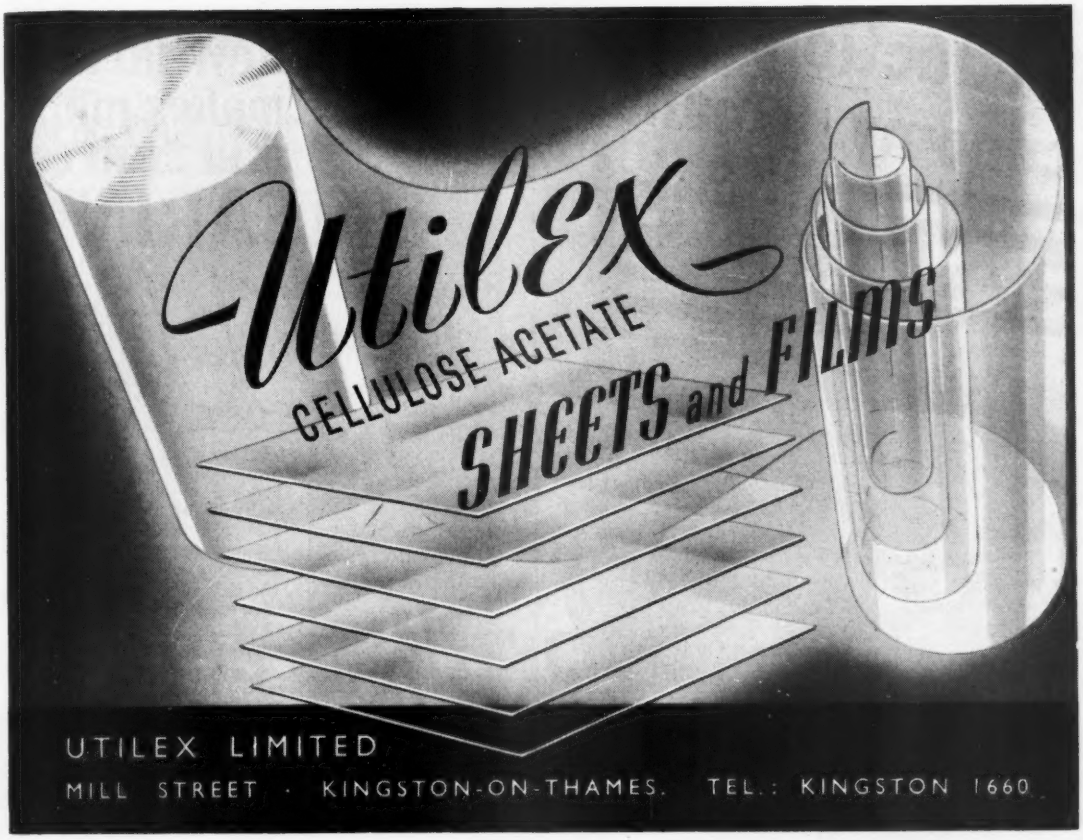

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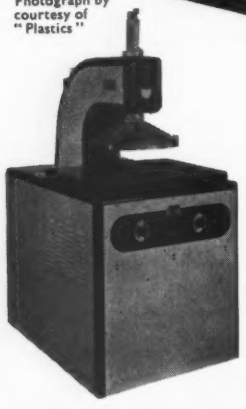

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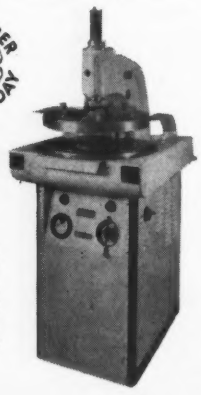

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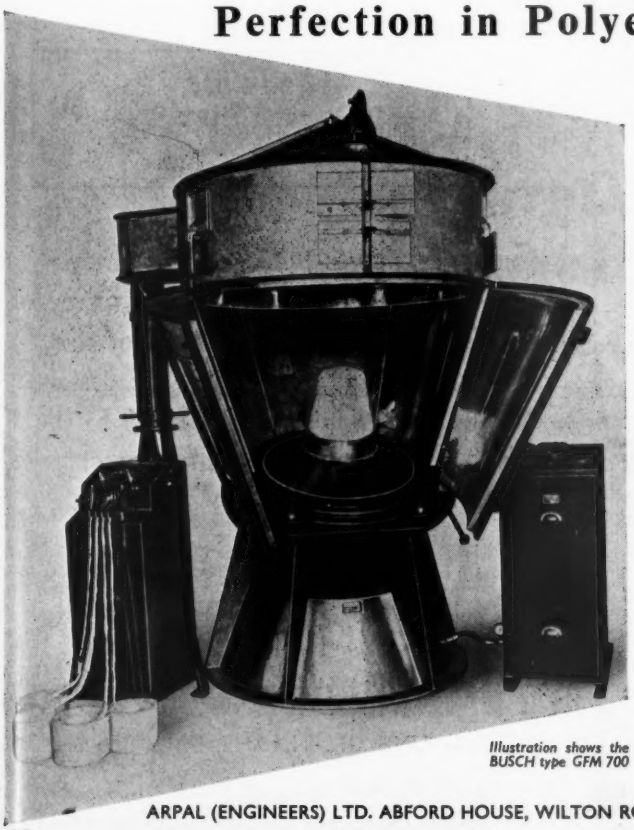

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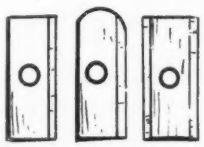

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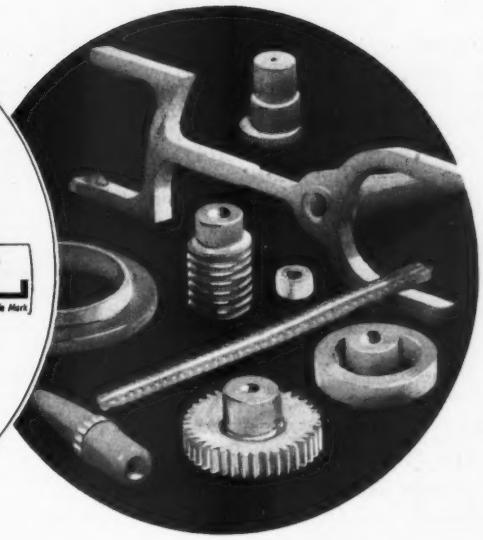

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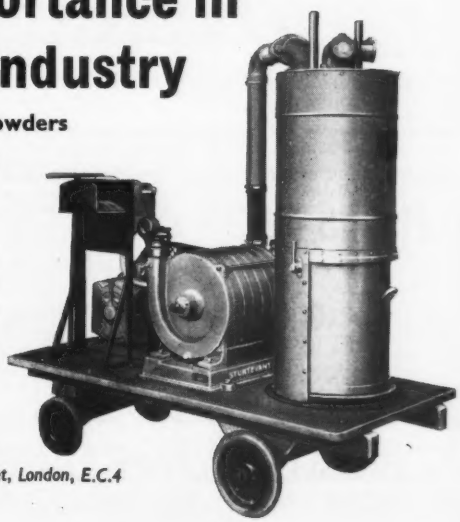

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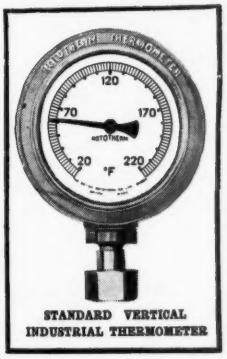

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GRANULATION plant available for reprocessing Acetate, Polystyrene, Polythene, and other Thermoplastic scrap. Materials ground to customer's requirements.

All enquiries to :—

JOHN CASTLE & Co. Ltd.
5 HURLEY ROAD, LONDON, S.E.11
Telephone : RELiance 4274/5

M. CALDERON LTD.

SPECIALISTS IN
THE MANUFACTURE OF
HEATING ELEMENTS
FOR THE
PLASTICS MOULDING INDUSTRY

ALL ENQUIRIES TO HEAD OFFICE
227 UPPER STREET,
LONDON, N.1 **CAN. 4252/3**

Wanted
STOCKS *for* CASH

We are cash buyers of merchandise of every description. Also Clearance Stocks, Discontinued Lines, Surplus and Redundant Stocks, **BOTTLES, Jars, Screw Caps, Cartons,** and other **Packaging Materials.** In fact, goods, of all kinds can be disposed of through us without delay, on the most favourable terms, and without trouble.

Should you have anything for disposal either now or at any future time please send us samples, full particulars and price on a cash settlement basis and the matter will have our immediate and careful attention.

RELIANCE TRADING CO.
1 NEW COLLEGE PARADE, FINCHLEY RD., LONDON, N.W.3

Does YOUR machinery look like this . . . . to your workers?

For perfect PROTECTION plus increased PRODUCTION install modern P.G. Guarding Equipment. Whatever the machine or process we shall be glad to help you. Literature and advice readily available on request.

378, FARM STREET
BIRMINGHAM, 19
Telephone : Northern 3354

PRESS GUARDS LTD

Southern Office : 11 Camden High Street, N.W.1. Tel. : EUSton 8382
Northern Office : 520 Stretford Rd., Manchester, 16. Tel. : Trafford Park 0250

Classified Advertisements

PRESS DAY.—Classified advertisements for the November issue must be received at Head Office by first post October 26th.
Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES.—4d. per word (minimum 12 words 4/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting 35/- per single column inch. Series discounts of 5% for 6, and 10% for 12 consecutive insertions allowed to trade advertisers.

TERMS.—Strictly net and prepayable. Monthly accounts or settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES.—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager "Plastics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors although every care is taken to avoid mistakes.

BOX NUMBERS.—Private advertisers desiring to have replies sent care of "Plastics" may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. To avoid mistakes in forwarding, Box Numbers should be carefully and legibly copied and replies sent to Box P000, care of "Plastics," Bowling Green Lane, London, E.C.1.

DEPOSIT SYSTEM facilities are available to readers to purchase advertised goods through "Plastics." Commission 1% (minimum 2/-) on amount deposited.

HEAD OFFICES: Bowling Green Lane, London, E.C.1, England. Telephone Terminus 3636. Telegrams: "Pressimus, Phone, London."

BRANCH OFFICES: 7, John Bright Street, Birmingham, 1. Telephone: Midland 4117-8. 50, Hertford Street, Coventry. Telephone: Coventry 62464. 1, Brazennose Street Manchester. Telephone: Blackfriars 5038-9. 12, Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

AGENTS WANTED

AGENT required by well established company, in field of sheet forming, with large press capacity and vacuum forming plant. Good opportunity to suitable person with experience in this field. Box P0728, care of "Plastics." 207-x3658

BUSINESS OPPORTUNITIES

FOR THE COMPLETE PROTECTION of blueprints, notices, documents, book covers, charts, drawings, and all printed matter, send today for full details of Morane Transparent Heatsealing Plastic Skin, The Morane Plastic Co., Ltd., 21 Woodthorpe Rd., Ashford, Middx. Phone, Ashford, Middx., 2727 and 3391. 207-4

SPANISH PLASTICS MANUFACTURER desires to introduce new materials and models suitable for injection moulding in Spain. Box P0726, care of "Plastics." 207-38

BUSINESSES, PREMISES, OFFICES, ETC.

HERTFORDSHIRE

in an accessible central position close to railway station in a town

30 Miles from London.

MODERN GROUND FLOOR FACTORY

FOR SALE WITH VACANT POSSESSION.

The building is of heavy steel construction with 18 ft. headroom. Concrete floor; roof of corrugated asbestos with glazing. Good loading facilities with access from two road frontages. In addition there are offices, stores, etc.

Floor area

SQUARE 60,000 FEET.

PRICE £85,000 FREEHOLD.

Plans are available, and for arrangements to view, apply

CHAMBERLAIN AND WILLOWS,

23 MOORGATE, LONDON, E.C.2.

(City 6013.) 207-1

LIGHT INDUSTRIAL AND DISTRIBUTING PREMISES FOR SALE (15 miles East Oxford) modern buildings, 5,000 feet super covered space (all ground floor) including excellent office block, central heating throughout, main services, fully concreted site of half an acre, providing ample room for expansion, good road frontage, easily accessible by road and rail, ideal for manufacturing plastics and first-class storage. Price freehold with vacant possession £7,000 or near offer. Apply Buckell and Ballard, 16 Cornmarket St., Oxford. Phone 4151 (3 lines). 207-14

CONSULTANTS

PULVERIZING, grinding, screening, consultant. E. D. W. Kidd, Weymede, Byfleet, Surrey. 209-x1072

MACHINERY, TOOLS AND PLANT

WESTMINSTER 3 INJECTION MOULDING MACHINES, up to 10 gram, perfect condition. Box P0718, care of "Plastics." 207-34

HYDRAULIC. Frazer Mono-radial pumps, new and second-hand, in stock. Thompson and Son (Millwall), Ltd., Cuba St., London, E.14. East 1844. zzz-483

HYDRAULIC POWER PLANT FOR DISPOSAL.
Two 3-throw pumps by Rice, giving 21 gal./min. at 1,500 p.s.i. direct-geared to English Electric Co. 35 h.p. unity power factor induction motors. Complete with oil-immersed starters and line switches.
Two ditto, giving 52 gal./min. at 400 p.s.i. geared to E.E.C. 25 h.p. slip ring motors Complete as above.
Two deadweight type hydraulic accumulators with 8 ft. stroke containing 13 gal. at 1,500 p.s.i. Complete with check, safety and motor relief valves.
Two ditto with 12 ft. stroke containing 60 gal. at 400 p.s.i. Complete as above.
All at Triplex Works, Kings Norton, Birmingham. 207-10

Machinery, Tools and Plant (contd.)

FOR SALE, two only, 40-ton Turner presses, self-contained units. May be viewed in London. Box No. P0719, care of "Plastics." 207-x3398

HYDRAULIC PRESSES

400-ton Greenwood and Batley upstroke hydraulic press with 16-in. dia. fescolized ram by 28-in. stroke and two 2¾-in. dia. pushback rams. Four columns 22½ in. by 20½ in. Table area 34½ in. by 22½ in. Daylight 3 ft. 4½ in. W.P. 2 tons sq. in.

100-ton downstroke hydraulic press by Finney. Ram 12-in. dia. by 20-in. stroke and two 2-in. dia. pushback rams. Four columns, distances between 20½ in. by 14½ in. Tee slotted tables 2 ft. sq. Daylight 32 in. Arranged for prefilling. W.P. 1 ton sq. in.

80-ton downstroke hydraulic press by Finney. Ram 10½-in. dia. by 18-in. stroke with two 2-in. dia. pushback rams. Four columns, 21 in. by 10 in. between. Tee slotted tables 18 in. sq. Daylight 30 in. Arranged for prefilling. W.P. 1 ton sq. in.

50-ton upstroke hydraulic press by Thompson, having 8-in. dia. fescolized ram and two 1-in. dia. pushbacks by 14-in. stroke. Four columns 20 in. by 5 in. Table 20 in. by 14 in. Daylight adjustable, 21 in. to 30 in. W.P. 1 ton per sq. in.

50-ton upstroke hydraulic press by Finney. 8-in. dia. fescolized ram and two 1½-in. dia. pushback rams by 20-in. stroke. Four columns 15 in. by 10 in. between Table area 16 in. by 15 in. Daylight 24 in. W.P. 1 ton sq. in.

Two 25-ton upstroke hydraulic presses by Thompson. 6-in. dia. fescolized ram by 12-in. stroke. Four columns 15½ in. by 6 in. Table 15½ in by 12 in. Daylight adjustable 18 in. to 12 in. Fitted are a pair of 1-in. dia. pushback rams. W.P. 1 ton sq. in.

Two 25-ton upstroke hydraulic presses by Plastics and Rubber M/cy. 4-in. dia. ram by 10-in. stroke. Four columns 11¼ in. by 6¼ in. between. Table 12 in. by 11¼ in. Daylight 13 in.

10-gramme hand-operated injection moulding machine by Francis Shaw, mounted on a steel frame, having two main tie bars 1½-in. dia. and 7½ in. between. Band type heater.

GEORGE COHEN SONS AND CO., LTD.,

WOOD LANE, LONDON, W.12.

Phone, Shepherd's Bush 2070;

AND

STANNINGLEY, NEAR LEEDS.

Phone, Pudsey 2241. 207-8

NEW HIGH SPEED ELECTRIC BANDSAW for sale, for cutting polythene, p.v.c., perspex, rubber, cork, leather, cloth, etc., stainless steel and wood table, three sizes 24 in., 30 in. 36 in., max. height of cut on 36-in. machine, 19 in., 400/440 3-phase supply, illustration and prices from makers. F. J. Edwards, Ltd., 359 Euston Rd., London, Euston 4681. 207-3

PLASTICS MACHINERY.

Hydraulic Presses of all sizes. Injection Machines. Extruders. Mixing Mills. Hydraulic Pumps and Accumulators.

Send your inquiries to the specialists,

REED BROTHERS (ENGINEERING), LTD.,

REPLANT WORKS,

CUBA STREET, MILLWALL, E.14.

Phone, East 4081 (five lines). 207-11

ALTERATIONS. Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings ex stock, keen prices. Contact G. L. Murphy, Ltd., Manston, near Leeds. zzz-210

MACHINERY, TOOLS AND PLANT WANTED

INJECTION MOULDING MACHINES REQUIRED, Condition or size not important. Send details. Box P023, care of "Plastics." 207-1062

WANTED, Masson Rotary cutter 24 in. by 12 in., would consider larger.
P. E. Rowe, Ltd., Langley Wharf, Chester Rd., Tyburn, Birmingham. 207-2

COMPRESSION AND INJECTION MOULDING TOOLS WANTED. Send details of your surplus, obsolete and redundant moulding tools. Box P0720, care of "Plastics." 212-1082

ONE 8 ft. by 4 ft. MULTI DAYLIGHT HYDRAULIC PRESS. 3,300 tons capacity approximately, platen suitable for heating by H.P.H.W. 120 lb. per sq. in. Box P0721, care of "Plastics." 207-43

INJECTION MOULDING MACHINE up to 1 oz., hand or power. Box P0727, care of "Plastics." 207-x3953

COMPRESSION MOULDING PRESSES required, downstroke about 100 tons, preferably with self-contained motor units. Box P0716, care of "Plastics." 209-1081

MISCELLANEOUS

EXTEND YOUR TRADE.
Use a trade mark. Consult
Trade Mark Protection Society,
12 Church St., Liverpool. zzz-478

MOULDS

SPECIALIST DESIGNERS of plastics moulds, compression, transfer and injection tools. Optimal Designs, 95 Mortimer Crescent, Worcester Park, Surrey. 207-x2714

IF YOU NEED
IMMEDIATE AND INEXPENSIVE
INJECTION MOULDING CAPACITY
FROM 2 TO 32 OZS.
(BUT ESPECIALLY 8 OZ.)
CONTACT US WITHOUT DELAY
AT BOX P0513,
CARE OF "PLASTICS." 210-1076

FOR SALE.—5 pocket comb moulds, various designs, 1 handled and 2 regular ladies Rattail combs, 1 barber comb, 2 fancy (ladies) dressing comb moulds, 2 soap box moulds, 1 vanity tray, 1 ladies vanity-combination lip-stick holder and compact and 1 compact mould, 1 garter and 1 toy boat mould, 2 cigarette case moulds, 1 sunglass Temple, 1 towel rod and 1 towel rack mould, 2 grip tooth comb and 1 Barette mould. All moulds are almost brand new and in guaranteed perfect working condition. Moulds are designed to fit the 8-oz. Reed-Prentice or any other 8-oz. injection moulding machine. For more details write to Dandy Plastics Co., 286 Fifth Avenue, New York City. 207-37

MOULDS WANTED

URGENTLY REQUIRED, cup, saucer and plate moulds. Box P0719, care of "Plastics." 207-x3399

PATENTS

HOLDER OF PROVISIONAL PATENT for domestic electrical gadget offers invention for sale or manufacture under licence. Inquiries, Box P0729, care of "Plastics." 207-x4354

PRODUCTION CAPACITY

INJECTION MOULDINGS AND PLASTIC COVERINGS in acetate alkathene, p.v.c. machined parts in brass, steel and plastics.
We now have extra capacity and can offer quick delivery at our new factory. We solicit your inquiries.
F. A. Ketch and Son, Ltd., Trent Valley Works, Lichfield, Staffs. Lichfield 3052. zzz-476

Production Capacity (contd.)

INJECTION MOULDINGS by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 208-1034

VISIJAR LABORATORIES, LTD.
THE LEADING CRAFTSMEN IN
" PERSPEX "
PROTOTYPE AND REPETITION.
OFFICIAL I.C.I. STOCKISTS " PERSPEX "
SHEET, TUBE, ROD.
STOCKISTS AND FABRICATORS OF " FORMICA."
149 LONDON ROAD, CROYDON, SURREY.
Phone, Croydon 1384. zzz-467

DINES PRODUCTS, Whitehall Lane, Grays, Essex, for injection mouldings. 211-1050

REPETITION in Ebonite, Erinoid, etc. Capstan lathe work. Temple St., Rugby. 210-1043

TUBE LAMINATION ENGINEERING, LTD.,
HIGH WYCOMBE,
BUCKS.
Phone 1921-2.
MAKERS OF
SYNTHETIC RESIN BONDED TUBES,
ROUND, SQUARE AND RECTANGULAR
FABRICATORS AND ASSEMBLERS
IN PLASTICS AND METALS.
FULL SUPPORTING MACHINE SHOP
AVAILABLE. zzz-472

SHORT RUNS A SPECIALITY: LONG RUNS A PLEASURE. Low mould cost and overheads. Injection capacity and technical knowledge at your service. Westminster Plastics, Temple Works, 41 Old Church Rd., Chingford, E.4. Silverthorne 7927. 212-01055

PLASTICS (MANCHESTER), LTD.,
BRITAIN'S LEADING STOCKISTS AND
DISTRIBUTORS.
SPECIALISTS IN
FABRICATION, INJECTION MOULDING AND
ENGRAVING.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and Central 1000. zzz-468

INJECTION MOULDINGS IN THERMOPLASTICS. Moulding in styrene acrylics and acetate. Design and toolroom facilities available for mould construction. Inquiries invited. J. and E. Courtenay, Ltd., 138 Stratford Rd., Birmingham, 11. 208-1067

ELCO PLASTICS, LTD.,
HIGH WYCOMBE, BUCKS.
Phone 1921-2.
OVER 50 PRESSES.
EXPERIENCED COMPRESSION, TRANSFER AND
INJECTION MOULDERS.
DESIGNERS AND MAKERS OF MOULDS
ON THE PREMISES.
CAPACITY UP TO 500-TON COMPRESSION
AND 10 OZ. INJECTION.
LARGE ASSEMBLY SHOPS.
A.I.D. APPROVED zzz-473

CHIPPING OF PLASTICS AND GRINDING, screening, mixing and drying of all raw materials undertaken for the trade. Crack Pulverizing Mills, Ltd., Plantation House, London, E.C.3. Man 4405. 207-44

INJECTION MOULDING
CAPACITY AVAILABLE TO
32 OZ.
SPECIALISTS IN PEN MOULDINGS
AT REALLY KEEN PRICES.
ROLLRITE PLASTICS,
HEREFORD.
Phone, Hereford 4782 209-1069

INJECTION MOULDING CAPACITY available up to 2 oz. in all thermoplastics materials. Case Development Co., Ltd., Kangley Bridge Rd., S.E.26. 207-36

INJECTION MOULDING CAPACITY available up to 3 oz., precision moulding a speciality. Guardian Plastics, 76 and 77 Rahere St., London, E.C.1. 210-1042

KINGSTON PLASTICS, LTD., Unity Works, Union St., Kingston-on-Thames. Manufacturers of virgin and second-grade cellulose acetate moulding powders, matched to customer's own requirements for colour and flow. Customer's own waste also reprocessed to specified requirements. Sorting and grinding incorporating magnetic separation of metallic particles of all thermoplastics undertaken. Phone, Kingston 8405. 207-1063

RAW MATERIAL

PERSPEX! PERSPEX!! PERSPEX!!! Official stockists for I.C.I. acrylic sheets. Sheets cut to your requirements. Fabrication and mounting specialists to the trade:—
S. C. Errington (Hanwell), Ltd., 132a Uxbridge Rd., Hanwell, London, W.7. Phone, Ealing 5288. zzz-460

ALWAYS LARGE STOCKS OF
CASEIN
RODS, TUBES AND SHEETS,
PERSPEX
SHEETS UP TO 1 IN. THICK.
CELLULOSE ACETATE
CATALIN RODS.
S.R. (PLASTICS), LTD.,
93 ALDERSGATE STREET, E.C.1.
Phone, Monarch 4686. 210-1037

SAVE TIME AND MONEY!
If you require a good service for turned parts in all plastics—or—
Supplies of casein, ebonite, fibre, laminated bakelite, in rods, sheets and tubes, or cellulose acetate and butyrate tubing, contact: A. E. Goodeve, Ltd., 188a Seven Sisters Rd., London, N.7. Archway 3654-6721. 211-1054

CUEX, LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose acetate.
Polyethylene.
P.V.C.
Polyvinyl butyral.
Perspex and Diakon.
Send now for details.
Cuex, Ltd., 27 Corporation St., Birmingham Central 5474. 207-13

NYLON SCRAP, reground, various colours, for disposal. Box P0715, care of " Plastics." 207-33

PLASTICS (MANCHESTER), LIMITED,
BRITAIN'S LEADING STOCKISTS
OF
PERSPEX SHEET, ROD, TUBE.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and 1000. 207-12

POLYTHENE, reground scrap in some colours for sale. Box P0711, care of " Plastics." 207-32

POLYSTYRENE, ground, clean, for sale. Write Box P079, care of " Plastics." 207-30

ACETATE SHEETS, 4 mm. coloured, unpolished, approx. 3 cwt., cheap. Box P077, care of " Plastics." 207-27

PHENOL FORMALDEHYDE MOULDING POWDER, some tons surplus to own requirements, below cost price, for sale. Inquire Box P071, care of " Plastics." 207-27

FOR HOME AND EXPORT MARKET. We sell at low prices, all plastic scraps, Acetate, Polystyrene, Alkathene, re-ground powders and reconditioned powders. Apply to Box P009, care of " Plastics." 207-45

BLACK CELLULOSE ACETATE MOULDING POWDER. We can always supply first grade at 2s. per lb., any quantity. Box P008, care of " Plastics." 207-46

RAW MATERIAL WANTED

WANTED, Polythene scrap. Write to Box P7416, care of " Plastics." zzz-0322

PROMPT CASH OFFERED for virgin and reprocessed cellulose acetate and polystyrene. Give manufacturer's name and packing. Box P873, care of " Plastics." zzz-464

POLYSTYRENE, any colour. Full particulars to Box P033, care of " Plastics." zzz-479

P.V.C. GARMENT AND HANDBAG OFFCUTS wanted. We collect and pay cash. Brockwell Plastics, Ltd., 50 Hollingbourne Rd., S.E.24. zzz-463

SCRAP
THE
LARGE BUYERS
ARE
MICHAEL S. STEVENS,
KESWICK ROAD WORKS, S.W.15.
Vandyke 3345-6. zzz-482

SURPLUS STOCKS of thermosetting and thermoplastic moulding powders wanted. Send details Box P056, care of " Plastics." zzz-481

ERLANOS, LTD., 93 Aldersgate St., E.C. (Monarch 4686), require Perspex and cellulose offcuts and scrap, clear and coloured, highest prices paid. 217-1079

Raw Material Wanted (contd.)

POLYSTYRENE AND POLYTHENE, any quantities of virgin material, scrap and nozzle lumps urgently wanted. Please offer with samples to Herbert Connor, Ltd., 120 Beaufort Park, Falloden Way, London, N.W.11. 207-28

SCRAP.
WE BUY
ALL THERMO-PLASTICS, REJECTED MOULDED
PIECES, OBSOLETE MOULDING POWDERS.
LUMPS, SPRUES AND RUNNERS.
AND PAY HIGHEST PRICES.
J. W. NASH AND CO., LTD.,
27 BEETHOVEN STREET, W 10.
Ladbroke 4655. 207-47

ACETATE SHEETING, clear 10 to 20 thou., any surplus lots required. Please offer with particulars. Box P073, care of " Plastics." 207-31

SITUATIONS VACANT

The engagement of persons answering advertisements in respect of vacant situations must be made through a local office of the Ministry of Labour, or a scheduled employment agency, if the applicant is a man between the ages of 18 and 64 inclusive or a woman between the ages of 18 and 59 inclusive, unless he or she, or the employment, is excepted from the provisions of Notification of Vacancies Order, 1952.

CHARGEHAND WANTED for extruding department of north-west rubber manufacturers. Must be fully experienced in all types of rubber extrusions. Give particulars of experience, age and salary required. Box P0515, care of " Plastics." 207-1074

PLASTICS TECHNOLOGIST
REQUIRED BY LARGE COMPANY
IN THE MIDLANDS.
EXPERIENCE IN P.V.C. COMPOUNDING AND
PROCESSING ESSENTIAL.
EXCELLENT PROSPECTS OFFERED TO RIGHT
APPLICANT.
Apply Box P074, care of " Plastics." 207-17

NORTH-WEST MANUFACTURERS require foreman able to control production of rubber and plastic conveyor belting. Excellent opportunity. State experience, age and salary required. Box P0516, care of " Plastics." 207-1075

IMPORTANT LANCASHIRE MANUFACTURING COMPANY whose products reach all branches of engineering industry require man with engineering background, age 27-35, for technical sales department.
Knowledge of plastics and glass textile reinforcement materials would be of considerable advantage. Give full particulars, in strict confidence, to Box P0612, care of " Plastics." 207-18

HYDRAULIC ENGINEER. A leading firm of machinery merchants with established business in hydraulic presses of all types and sizes and rubber and plastics machinery, require a commercial assistant to take charge of an office in the Shepherd's Bush district and to be responsible for the purchases and sales. Applicants should have had a sound engineering training and commercial experience, and be capable of assuming responsibility. Starting salary in accordance with qualifications. Excellent opportunities of promotion. Apply, giving details of age and experience, to Box P0717, care of " Plastics." 207-35

CHEMISTS OF CALIBRE, both in the field of vinyl plastics and rubber technology, required for permanent appointments. An Honours Degree, and some industrial experience, will almost certainly be indispensable. Emoluments, including contributory pension scheme, will be in line with calibre.
Applications, which will be treated in strictest confidence, should be addressed, in the first instance, marked " Confidential," to the Secretary, Storey Brothers and Company, Ltd., White Cross, Lancaster. 208-1080

M. AND B. PLASTICS, LTD., require a Sales Representative for territory covering South London and Kent. Age 20-23. Previous sales experience desirable but not essential provided sound education with scientific or technical background. Residence in the South London area will be necessary. Permanent and pensionable position with prospects of advancement. Apply initially in writing to the Personnel Officer, M. and B., Ltd., Dagenham, Essex, quoting reference No. 6. 207-5

COMPANY requires the services of a man fully experienced in plastic injection moulding techniques. Some experience with nylon preferred. Suitable applicant will be engaged for the position of foreman of proposed new department. Howard Clayton-Wright, Ltd., Wellesbourne, Warwick. 207-6

SHOP FOREMAN required in S.W. London for Extruded Plastics Factory, age 30-40, capable of controlling male and female labour. Some engineering knowledge or experience essential. Good prospects. Write to: Thos. De La Rue, Dept. D.T., Imperial House, Regent St., W.1. 207-7

Situations Vacant (contd.)

COMPETENT TOOL DRAUGHTSMAN required, experience in plastic die design preferred but not essential. Write, giving details of experience and qualifications. Box P0724, care of "Plastics." 207-40

QUALIFIED CHEMIST having extensive knowledge of synthetic resins, capable of developing resin formulations for use with paper, fabric and glass, required by a public company in the London area. Salary around £1,000 per annum. Apply Box P0722, care of "Plastics." 207-42

WORKS MANAGER
REQUIRED FOR
LONDON PLASTICS FACTORY.

MUST HAVE HAD EXTENSIVE MASS PRODUCTION EXPERIENCE IN COMPRESSION MOULDING AND/OR PAPER IMPREGNATING AND LAMINATING.

SALARY £2,000-£3,000,
DEPENDING ON EXPERIENCE.
ALSO TURNOVER BONUS.

WRITE FULL PARTICULARS OF PAST EXPERIENCE IN STRICTEST CONFIDENCE TO MANAGING DIRECTOR, BOX P0723, CARE OF "PLASTICS." 207-41

EXPERIMENTAL ENGINEER required for work on plastic compression moulding of specialized electrical components. General mechanical experience an advantage. Factory location London, E.18. Write Box P0725, care of "Plastics." 207-39

IMPORTANT LANCASHIRE MANUFACTURING COMPANY whose products reach all branches of engineering industry require man with engineering background, age 27-35, for technical sales department.

Knowledge of plastics and glass textile reinforcement materials would be of considerable advantage. Give full particulars, in strict confidence, to Box P0612, care of "Plastics." 207-9

AUSTRALIA. Large Sydney Plastics Company require first-class man for modern extrusion plant making film, sections, wire covering, etc. First-class man for moulding or reinforced plastics (glass fibre, etc.). Write A.C.I., Ltd., 44 Bedford Row, London, W.C.1. 207-15

Situations Vacant (contd.)

PLASTIC MACHINE ENGINEER required to take responsibility for shop erection and installation of a new line of large plastics injection moulding machines to be manufactured by an established engineering firm in the Sheffield area. Practical knowledge of moulding machine manufacture and operation is essential, and sales engineering experience would be an advantage. The post will be permanent and offer scope for advancement for a capable and energetic man. Apply Box P075, care of "Plastics." 207-16

REQUIRED: Young experienced Salesman to cover sales of Thermoplastic raw materials in the Greater London Area.

Apply in confidence, stating age, experience and salary required to Box P072, care of "Plastics." 207-18

EXTRUSION P.V.C. Assistant manager required by works near London, able to take charge of production. Apply Box P0714, care of "Plastics." 207-21

DRAUGHTSMAN required by electrical manufacturer for interesting design work on plastic moulds and associated jigs. Location London, E.18. Write particulars, experience, Box P0713, care of "Plastics." 207-22

CABLE MAKERS require chemist, experienced in manufacture and manipulation of plastic and allied compounds to control expanding department, salary according to experience and ability. Apply Box P0711, care of "Plastics." 207-23

DESIGNER OF PLASTICS MOULDS, preferably with experience in moulding, required by plastics manufacturers, should be able to take charge of small drawing and estimating office. Applicants should submit full details of their experience together with salary required. A flat is available for suitable married applicant; assistance will be given in finding suitable accommodation for a single man. Please reply to Box P0710, care of "Plastics." 207-24

DRAUGHTSMAN with knowledge of modern injection-moulding methods required by plastics division of an established company in North-west London to produce general arrangement and detail drawings. Apply, stating experience, age and salary required, to reference DA/7, Box P078, care of "Plastics." 207-25

ASSISTANT TO WORKS MANAGER, aged 25-35 years, with degree in chemistry or engineering or similar qualification, required for modern plastics factory S.E. of London. Applicant must be thoroughly acquainted with technology of P.V.C. An important appointment offering excellent prospects, pension scheme. Full details to Box P076, care of "Plastics." 207-26

DRAUGHTSMAN. Man with experience on plastic mould design and with good general engineering background required to take charge of small drawing office, good prospects for young man with energy and initiative. Apply to Personnel Manager, Halex, Highams Park, E.4. 207-19

Situations Vacant (contd.)

APPLICATIONS ARE INVITED from first-class salesmen to fill a vacancy within the organization of one of Britain's leading plastic manufacturers. Applicants should have, if possible, previous experience in handling P.V.C. films, with particular reference to the rainwear, making-up, fancies and pharmaceutical trades. Remuneration will be by salary and commission, and the position is pensionable. A car will be provided.

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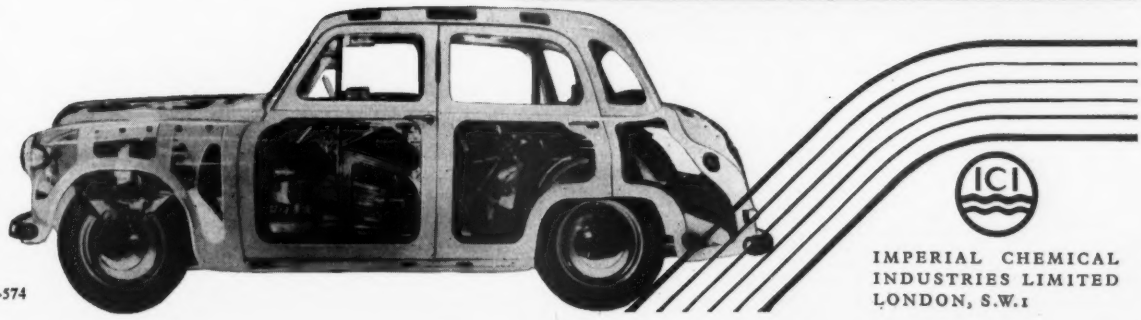

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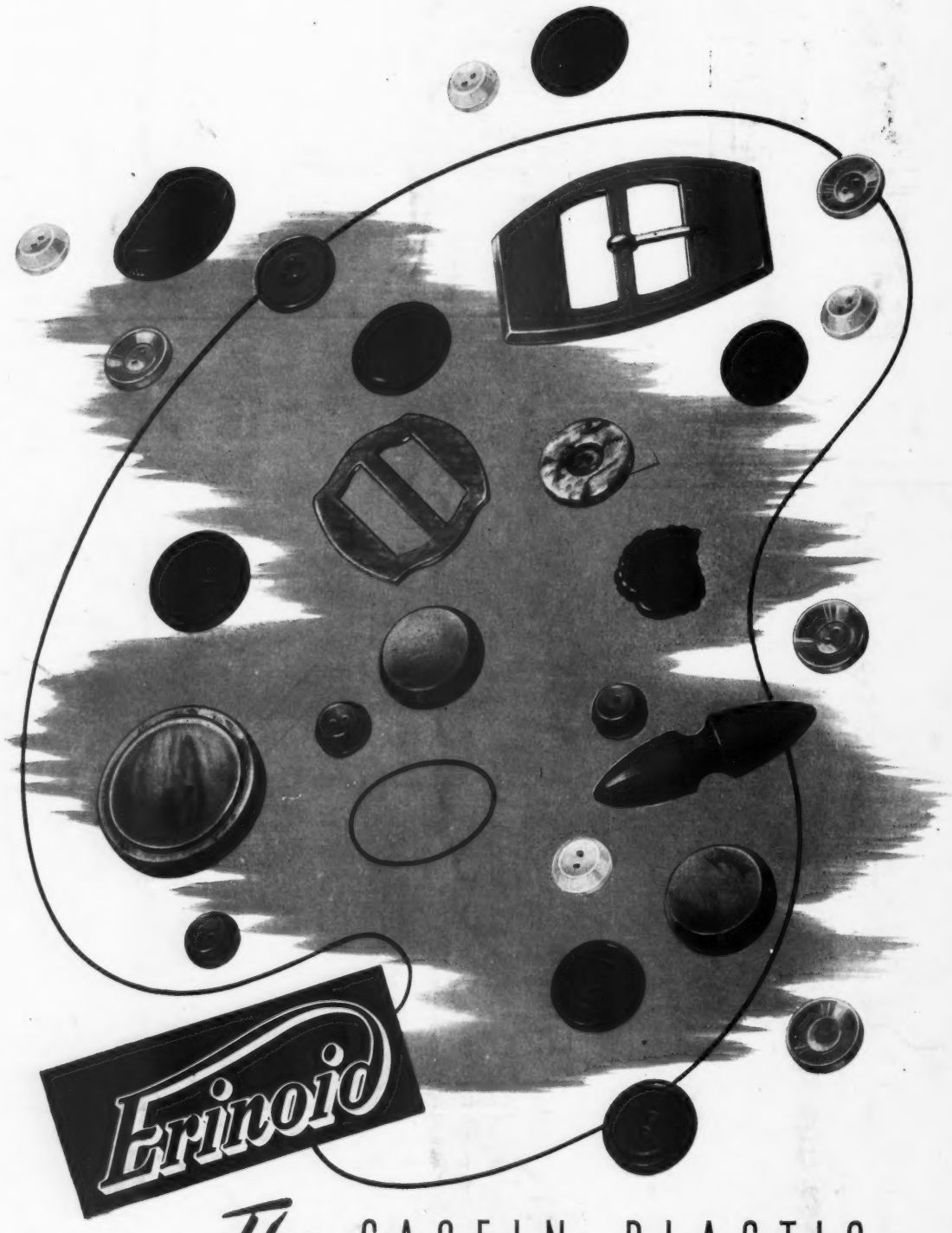

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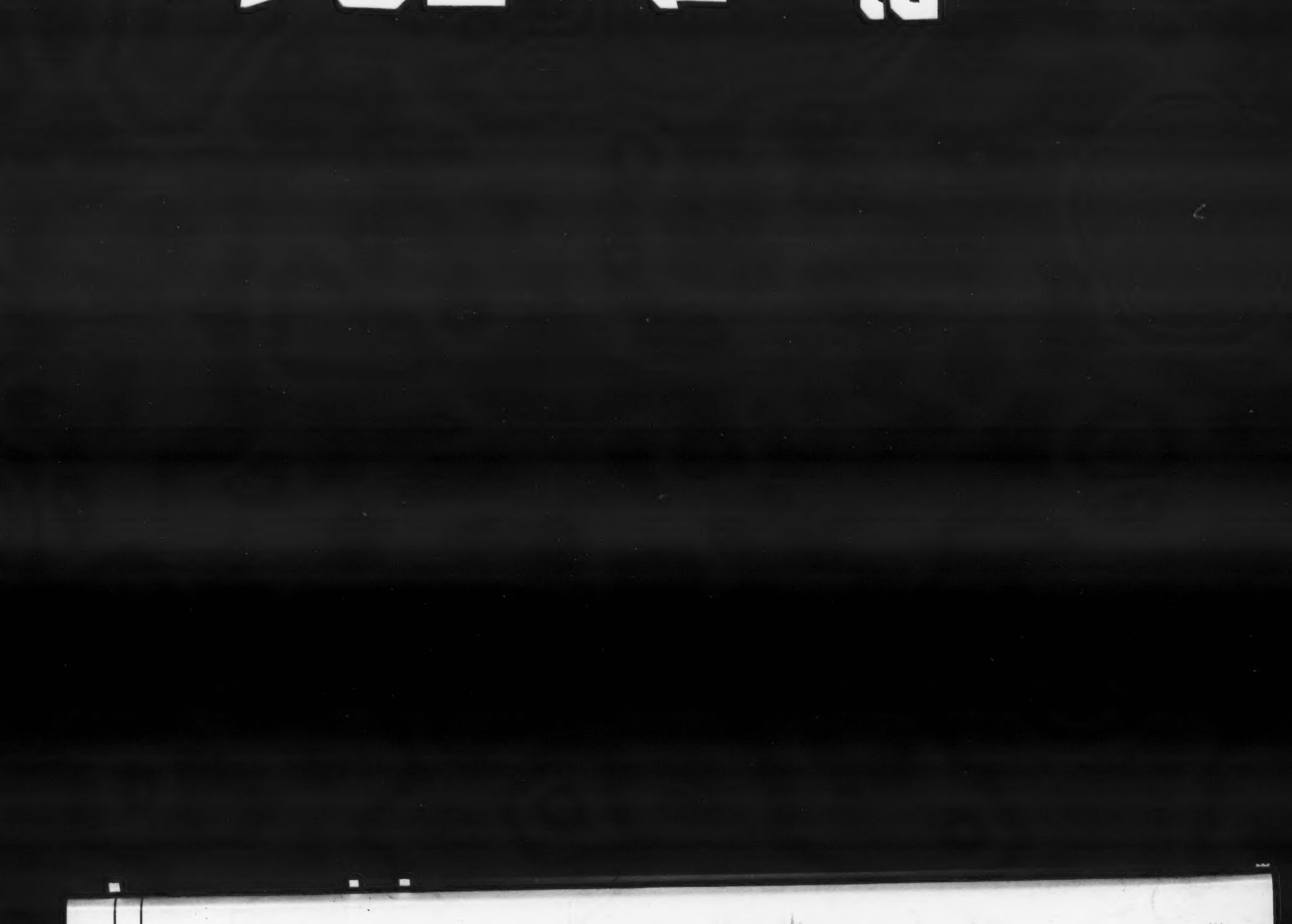
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